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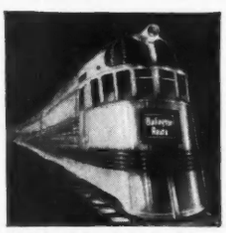

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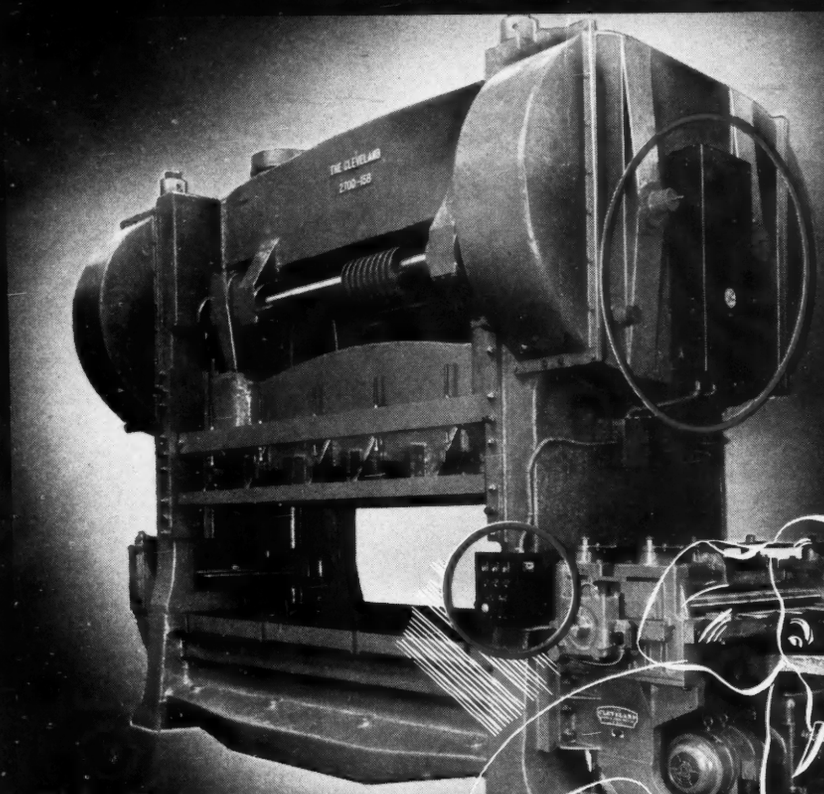

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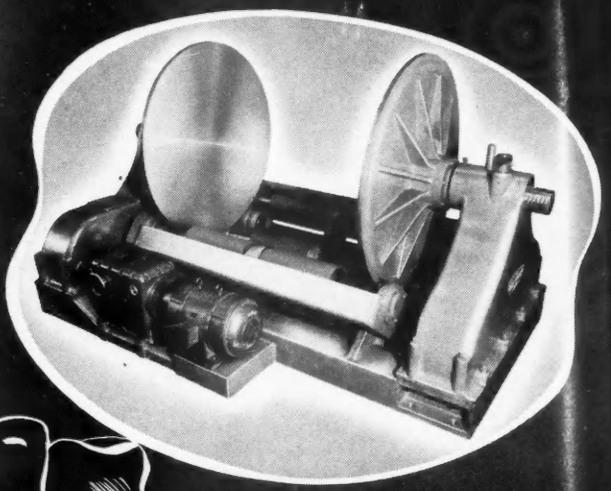

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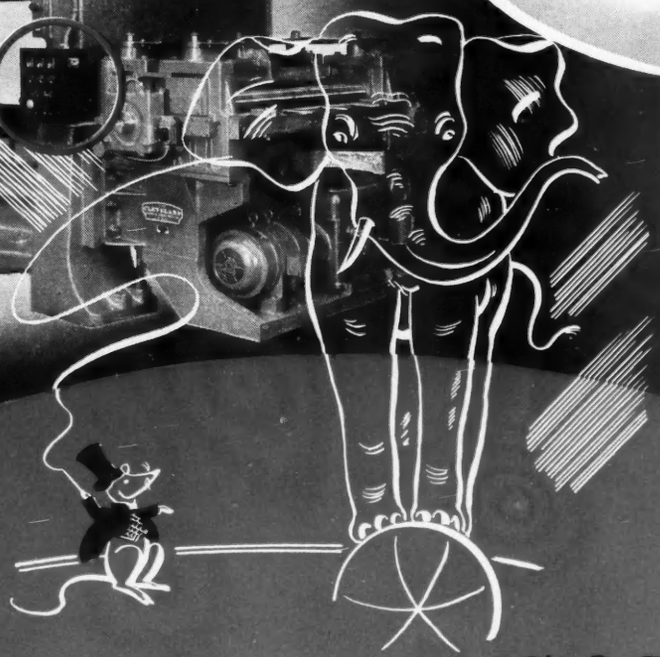

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The AUTOMOBILE

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Published Weekly

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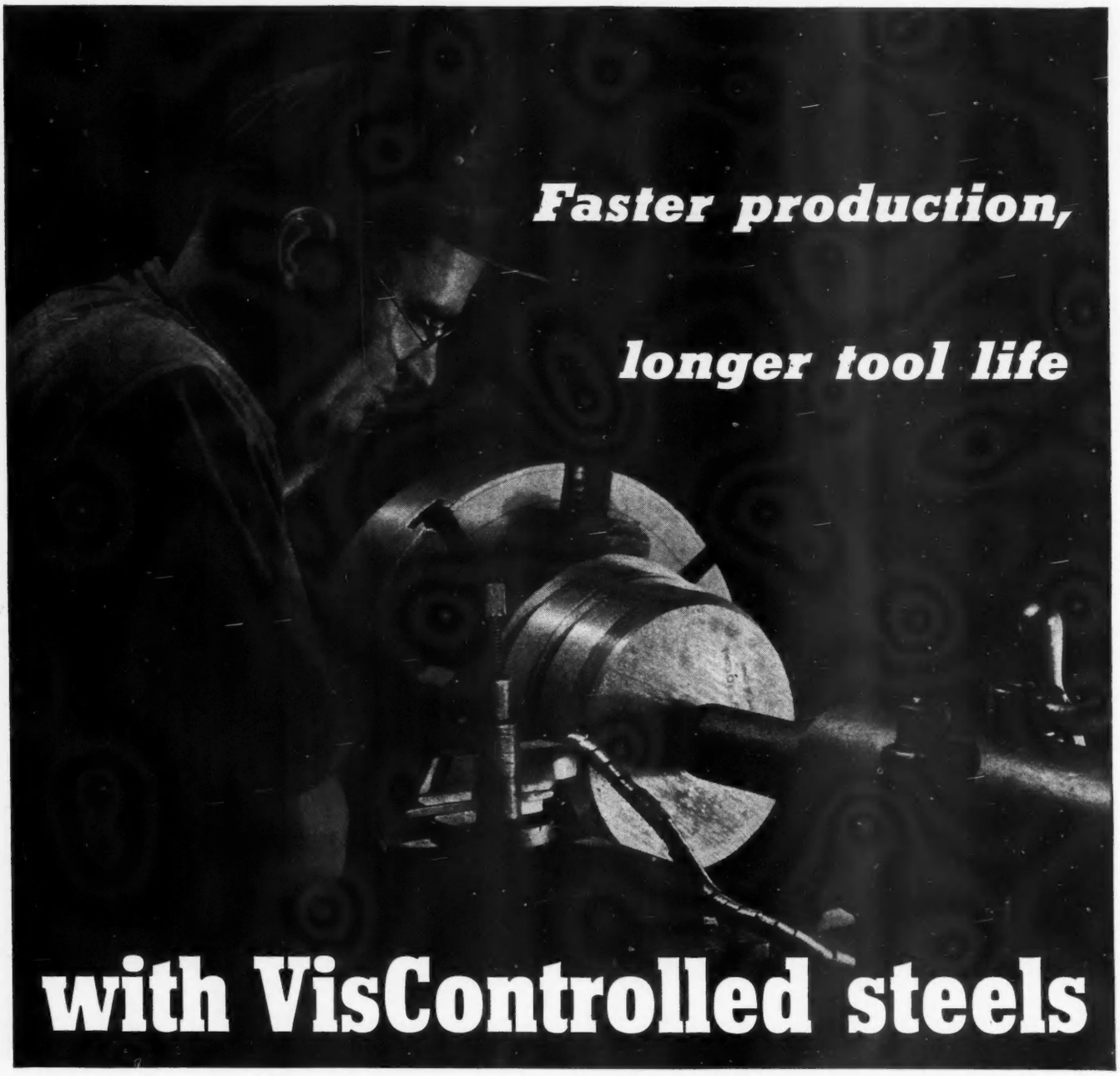

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Published Weekly
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AUTOMOTIVE INDUSTRIES

September 4, 1937
Vol. 77, No. 10

Sales Volume "Happy Surprise"

Car Company Officials Pleased With Business Following Price Increase; 360,000 Units Seen This Month

Automobile officials are happily surprised at the way sales have held up following the recent price increases. Uncertain as to the effect the advances would have on the market, sales officials have kept a close eye on the public reaction as revealed by dealer deliveries not only to gage the possibilities for a cleanup of outgoing models but to get an indication of 1938 prospects. They have found no little encouragement in the delivery figures for the reporting periods after the price boost, declaring business to be better than they had anticipated.

In many quarters sales slumped somewhat immediately after new prices went into effect but this was expected and was regarded as not reflecting so much the public reaction as the void created by the crowding in of deliveries before the deadline on old prices. In a number of instances, some advance notice was given with the result that sales were stimulated just prior to the price change causing a slump immediately afterward. Where new prices have been in effect for some time, sales have staged a comeback following a brief sinking spell.

Now it appears that August will show only the normal seasonal decline despite the price increases put into effect by many of the manufacturers. A year ago, sales of cars and trucks dropped 17 per cent from July to August. This year, eight companies reporting for the first 20 days of August show a drop of less than 10 cent from the corresponding period of 1936. The industry delivered 330,000 vehicles in August last year, and if the trend shown by the eight companies reporting for the first 20 days of August is representative of the industry for the full month, then August deliveries should exceed 360,000 units. July this year dropped only 5.1 per cent below the June volume, compared with a decline of 11 per cent from June to July last year.

From now on, sales will begin to reflect the thinning out of dealer stocks as factory shipments of 1937 models have been discontinued by a majority of the car makers. With further price increases expected on 1938 lines, a true gage of the market's ability to absorb the new price levels cannot be had until well into the new model year.

With most companies now out of production while tooling up for 1938 models, the industry's output still remains at a fairly high level since the two volume producers, Ford and Chevrolet, are among the few still producing 1937 cars. They probably will not cut off until close to the middle of September.

H. E. G.

Maintaining its fast summer pace, the Buick division of General Motors retailed 5612 cars in the United States during the second 10 days of August bringing total deliveries for the first two periods to 11,510 units. This compared with 5359 cars delivered during the second 10-day period of August last year and with 9013 for the first twenty days of the month a year ago. According to W. F. Hufstader, general sales manager, this year's August volume is the best since 1929 at which time new models were being introduced. Mr. Hufstader said used car sales for the second 10 days totaled

(Turn to page 298, please)

Sees Prices Up Again

Sloan Forecasts Further Increases; Costs High

There will be increased prices for automobiles when the 1938 models are introduced, Alfred P. Sloan, Jr., chairman of the board, General Motors Corp., said, Aug. 29, when he returned from a vacation and business trip in Europe.

"Prices had to go up and they will probably go further, in some cases, before the introduction of the new models. Higher material and labor costs have forced the prices up. As remarkable as they have been, the economies of improved production methods and techniques have not been able to offset the increases in wages and material prices."

"I don't expect any radical changes in the 1938 models," Mr. Sloan said. He thought there would be numerous refinements, and a decided increase in automatic shift transmissions and the overdrive.

It will be "very many years" before Diesel engines will be used in passen-

(Turn to page 303, please)

Diamond T Raises Prices Others May Follow

The Diamond T Motor Car Co. has increased prices on its trucks $20 to $70 effective Sept. 1. As we went to press, a telegraphic survey of the industry had brought in insufficient returns to determine whether the move would become general.

Truck registrations have been running at record levels this year but profits have not kept pace with sales. For the same reasons of higher costs for labor and materials that impelled most passenger car manufacturers to raise prices recently, the truck companies may well move to protect their profit margins. It has been pointed out that when manufacturers' 1937 commitments for materials run off, they will have to pay still higher prices than they paid for at least part of the present season.

DeSoto Adds to Facilities

An extensive expansion program, which will materially increase DeSoto's production facilities, is announced by Byron C. Foy, president of the DeSoto division of Chrysler Corp.

New facilities will include construction of a third story for the assembly building, lengthening of the chassis and final assembly lines, and installation of new banks of presses in the press plant building.

A new frame receiving building is being erected as a part of the program that calls for a 250 ft. extension of the chassis and final assembly lines, which will give a greater car capacity per day to the plant.

Shipping facilities will be speeded with the erection of a new head house that prepares new cars for shipment, and the construction of new loading dock facilities. A new personnel building is nearing completion at the McGraw entrance to the plant.

More than 100,000 sq. ft. of floor space will be added to the assembly building with the construction of the third story, to be utilized for additional paint spray equipment and for storage of bodies and parts.

UAW Votes Central Control

Martin Forces Win Close Battle at Milwaukee Convention; Hit Unauthorized Strikes; to Continue Ford Drive

Homer Martin's so-called progressive forces emerged victorious in the close and bitterly fought contest for control of the United Automobile Workers International Union as its second annual convention closed in a stormy session at Milwaukee Sunday night, Aug. 29. Only by the narrowest margin was a serious split in the ranks averted, thanks to the efforts of CIO leaders, including John L. Lewis, who pleaded eloquently for harmony and a united front against employers.

Both sides gave ground and a compromise was reached after eleventh hour caucuses which permitted disposal of the most controversial issues including election of officers and members to the executive board. Although wearied by the week-long strife, opposing delegates fought stubbornly to the end. Martin was charged with steam-roller tactics. One first fight occurred. Additional police were called to preserve order and four sergeants-at-arms were detailed as body-guards for Martin. At one time the unity faction threatened to stage a sit-down strike at the edge of the platform until their spokesmen were recognized by the chair. But Martin's oratory finally prevailed and unity party leaders gave up their fight "For the good of the auto workers."

Compromise

Under the compromise, opposing slates of vice-presidential candidates were combined. Homer Martin, unopposed for the presidency, was re-elected. The number of vice-presidents was increased to five, all of equal rank. Martin was forced to yield on the matter of ousting vice-presidents Wyndham Mortimer and Ed Hall, who with Walter N. Wells, were re-elected. The two new vice-presidents are: Richard T. Frankensteen, who has been director of organization, and E. J. Thomas, president of the Chrysler local.

Thomas was a member of the employe representation plan in the Chrysler plant, under the NLRB plan but broke with that body and led in the formation of the Automotive industrial Workers Association which later joined the UAW. He is also president of the Detroit district council of auto workers. Thomas at one time studied for the ministry. Frankensteen, 30 years old, was a football captain in his high school days and also attended college. He assisted Thomas in organization of the AIWA at the Dodge plant and is president of the Dodge local. He heads the Ford UAW organizing committee.

Membership of the executive board was increased to 17 from 12. Michigan was given two additional members and Ohio, California and Canada each one more. Of the 17 members, 11 are said to be Martin supporters, the unity group being able to claim but six. Division of the official family is understood to be as follows: Martin, Frankensteen, Wells and Thomas on the "progressive" side, and Mortimer, Hall and George Addes, secretary-treasurer, on the "unity" side.

With a 15 to 9 majority of the officers and board, Martin is considered to have dictatorial power over the union. Thus the Martin policies may be expected to prevail, which means strict discipline and centralized control. The slogan of his party at the convention was "Highly centralized authoritative leadership." The unity group's slogan was "Disciplined democracy." Delegates abbreviated the slogans into "Dictatorship vs. Home Rule." In line with the Martin policy, the convention voted to uphold present constitutional provisions on authorization of strikes, condemning all strikes not approved by the executive board.

With reference to the strike issue, Martin said: "Nothing is more dangerous to the labor movement than irresponsibility of divisions within a union. We have national agreements with these great automobile concerns and strikes certainly are a national problem. Beyond that, we expect to get an agreement with the Ford Motor Co., and eventually we expect a closed shop in the entire automobile industry."

Ford Drive Plans

The convention unanimously approved a resolution to assess all UAW members $1, thereby raising a fund of $400,000 to carry on a Ford organizing campaign. "The Ford company's open shop maintains a threat to union wages and conditions in Chrysler and General Motors and hinders the progress of the auto workers," said the resolution.

Martin said that the only strikes the UAW has lost were those called by local representatives. "In one week we paid $10,000 to attorneys because of the blunders of these men," he stated.

Salary increases were voted all officers. President Martin was increased to $5,000 a year from $3,000. Salaries of the vice-president and the secretary-treasurer were increased to $4,000 from $3,000 annually, and board members, who drew $8 a day when in session last year, were placed on salary basis of $3,000 a year. Including the two additional vice-presidents, total payroll for officers is $29,000 as against $15,000 in previous year. Executive board members will draw $51,000 annually so that the total payroll for officers and the board comes to $80,000 a year. The amount paid board members last year is not available for comparison.

The new officials will hold office for two years since the delegates voted to hold biennial conventions. Toledo was chosen for the 1939 convention.

RAY A. DEVLIEG

. . . named general works manager, Nash Motors division of Nash-Kelvinator Corp. He has been associated with automobile manufacturing since 1910.

Canadian Ford Output Up

Production of the Ford Motor Co. of Canada, Ltd., East Windsor, Ont., increased approximately 30 per cent in the first six months of 1937 over that for the corresponding period of 1936, it is understood. This gain was shared about equally by the Canadian market and the company's export business.

The company is nearing the end of its expansion program. Started early in 1937, this program is intended to increase manufacturing facilities at the East Windsor, Ont., plants by about 25 per cent and give the company an eventual capacity of 100,000 units per year.

Knudsen to Speak

W. S. Knudsen, president of General Motors, will be the principal speaker at the annual meeting of the nationwide Buick field organization in Flint, Wednesday, Sept. 1. Mr. Knudsen will speak at the annual banquet Wednesday evening, sharing the program with Harlow H. Curtice, Buick president. The day will be devoted to business sessions of the field sales organization, which will be under the direction of W. F. Hufstader, general sales manager. In addition to the distributor organization, a number of General Motors officials and members of the Buick manufacturing staff, headed by O. W. Young, general manufacturing manager, will attend the session.

Car Financing Down

July Below Previous Year First Time Since 1929

Retail automobile financing declined sharply both from July, 1936, and from June, 1937, a preliminary computation by the Department of Commerce shows. The decline from June, 11 per cent, is the third largest such seasonal drop since 1929. In 1930 it was 20.9 per cent and in 1932 it was 34.5 per cent. The decline from July of last year was 9.7 per cent, marking the first break in a series of July gains since 1929.

The department reported that retail

financing for seven months was 3 per cent below that for the like portion of last year, but 56 per cent over the 1935 volume.

The reports were based on weighted figures reported to the department by a group of companies doing three-quarters of the business.

Meanwhile, the department released a preliminary index figure for retail automobile sales in July on a dollar basis which showed that without seasonal adjustment, car sales droped from 134.3 in June to 123.5, but that with seasonal adjustment the index was up from 99.0 to 105.0. Both indexes showed gains for July over July, 1936.

Declares an Extra

Directors of Commercial Credit Company declared a quarterly dividend of $1 per share and an extra or special dividend of 50 cents per share on the common stock, and also quarterly dividend of $1.06¼ per share on the 4¼ per cent cumulative convertible preferred stock. These dividends are payable on September 30 to stockholders of record at the close of business September 10, 1937.

"Customer Relations"

Pontiac Finds Out How Its Car Owners Like Things

Within the general heading of "consumer research" as it is envisioned and practised by General Motors Corp., several divisions of the company maintain "customer relations" departments. Consumer research means more than the effort to discover what the public wants in its automobiles—it means also finding out how the public wants to be treated. Customer relations leans more toward the latter phase of the picture. The company feels that the data gathered is vital to its sales success.

An example of the operation of a customer relations department is that of the Pontiac division, directed by B. A. Kissam. It is his work to know what Pontiac owners think of their cars, the dealers from whom the cars were bought, the service, the trade-in allowances, the finance charges and other matters.

Says the company:

"The chief source of owner information and owner comment is the thousands of letters received in reply to the personel letter that goes out over the signature of H. J. Klingler, Pontiac general manager, sixty days following the delivery of every new Pontiac car.

"Record is kept of the dates that the Klingler letters are mailed so that the number of replies received can be checked accurately.

"The first seven months mailings of Klingler letters covering the 1937 production, and beginning sixty days after first deliveries were made, totalled 85,502. Replies addressed to Mr. Klinger amounted to 17,565 or 20.6 per cent. Highest percentages were recorded in January, February and March when the percentages were 25.2, 24.3 and 22.1, respectively.

(Turn to page 298, please)

Re-centralization for Tires?

Heavy CIO Vote at Akron Gives Industry Pause; May End Movement of Production From That City

URW to Extend Drive To Branch Plants

On the basis of its victories at Akron, the United Rubber Workers of America now expects to seek National Labor Relations Board elections in the California plants of the Goodyear Tire & Rubber Co. and the B. F. Goodrich Co., and then in all the subsidiary plants of the two companies in the United States.

The URW will also move promptly to secure collective bargaining contracts with the companies at Akron. The union, a CIO affiliate, won both company elections by the composite vote of 16,753 for union representation and 4027 against it.

The Goodyear vote, on Aug. 24, was 8464 to 3193 in favor of the URW. The Goodrich vote, Aug. 26-28, was 8289 to 834 for the URW.

Will the CIO victory scored by a 4 to 1 margin in two NLRB collective bargaining elections in Akron be the signal for further decentralization of the Akron tire industry — or will it halt decentralization plans and result in a re-centralization of the tire industry in Akron?

Opinions among tire industry observers are divided. First reaction to the overwhelming CIO vote at Goodyear and Goodrich, Aug. 24-28, was that this unexpected showing of the CIO's strength would immediately accelerate decentralization programs which have been in progress for the past year. The reaction on the rebound however was that Akron tire manufacturers scarcely could expect to run away from labor trouble or from the CIO; that Akron was the logical tire manufacturing center; that operation of widely scattered branch tire plants meant heavy increases in overhead operating expenses and that there probably would be a slowing down in the progress of decentralization with an ultimate return of tire manufacture to Akron.

Decentralization of the Akron tire industry was virtually forced by car manufacturers who look to three Akron firms for more than 70 per cent of all their original equipment tires. A year and a half ago when Akron was in the throes of one major strike and dozens of spasmodic sit-down strikes, automobile manufacturers issued the mandate that they must have sources of supply free from the danger of such stoppages.

Interested in holding the business of their biggest customers, Goodyear, Goodrich and Firestone decentralized. They bought idle plants in several cities, built new factories, closed down Akron departments and transferred tire building machinery. All in all the "Big 3" of Akron moved perhaps 25,000 to 30,000 daily tire production out of Akron. Many millions were spent for new factories and for renovating and equipping old ones. Manufacturers of tire building machinery received an avalanche of rush orders for machinery.

The Ford Motor Company started plans for its own tire plant and borrowed a group of Firestone engineers. This Ford tire plant will be operating before the end of the year, and in view of the strength already shown by the CIO in the Akron tire industry, some feel it may become the CIO's place of entry into the Ford ranks.

General Tire Plans Stores

General Tire & Rubber Co. has organized the General Tire and Auto Supply Group Buying Association to open independently owned stores called GTAS (General Tire Auto Stores). These stores will carry approximately 2400 miscellaneous items including tires and nationally advertised merchandise.

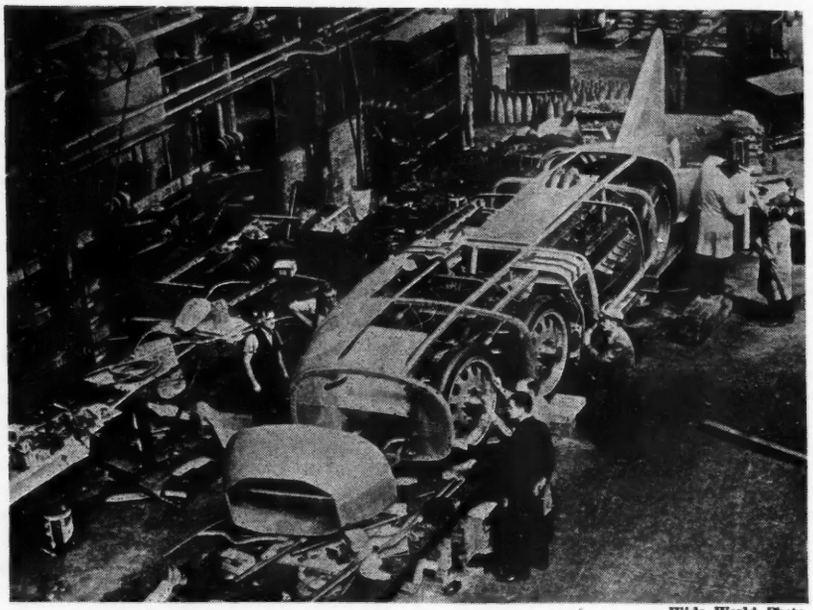
This department is under the supervision of Gus. J. Schaffner, Jr.

Annual Meeting

The annual meeting of stockholders of The Four Wheel Drive Auto Company will be held September 14, at the Clintonville Armory auditorium, at 10.30 a. m. Announcement of the meeting was made in a letter to stockholders by Frank Gause, secretary of the company. Stockholders at the meeting are to choose three directors to succeed J. D. Cotton, Chicago; Max Stieg, Clintonville; and D. S. DeWitt, Oconto, Wis.

CHAUNCEY WILLIAMS

. . . newly appointed general factory foreman, Clintonville, Wis., plant, Four Wheel Drive Auto Co. He has been given full charge of FWD truck production.



Wide World Photo

IT *IS* A CAR This is the new "mystery" racing automobile being built for Capt. G. E. T. Eyston, British driver. It has four steering wheels and duals at the rear. It will be driven by two engines developing 3250 hp. and will be 30 ft. long and weigh six tons. Capt. Eyston, who has already come to this country for other races while the car is being completed, will try to reach 400 m.p.h. with it on the Bonneville Salt Flats in Utah.

MEN OF THE INDUSTRY

MAX H. SCHACHNER has been appointed as assistant sales manager of the Winton Engine Corp., subsidiary of General Motors, it is announced by William J. Davidson, general sales manager of Winton. His principal responsibility will be direction of the sale of the new Winton two-cycle diesel engine to manufacturers and distributors.

FRED A. HAHN, of Chattanooga, Tenn., and **DEAN B. COPELAND,** of Butler, have been named to the board of directors of The American Bantam Car Company, R. S. Evans, president of the company announced. Mr. Hahn is president of the investment brokerage firm of Fred A. Hahn Company, Chattanooga. Mr. Copeland is vice-president and director of the Butler County National Bank and Trust Company here.

W. F. Sturm Dies at 53

Widely-Known Racing Editor and Writer Passes

William F. Sturm, automobile racing editor of the Indianapolis *News* and holder of many early cross-country records, died Aug. 25 at 53.

In addition to his background of driving, Mr. Sturm was manager for many racing drivers including the late Maj. O. D. Seagrave, Sir Malcolm Campbell and Kaye Don, all Britons. Among his American charges were the late Frank Lockhart and "Cannonball" Baker. With Baker, Mr. Sturm was co-holder of the first round trip across the continent.

Twenty years ago, Mr. Sturm held the coast-to-coast record of 5 days, 17 hr., 33 min.

Mr. Sturm himself covered every Indianapolis Speedway race since the track was opened in 1909.

May Drop Parts Price Cases

The recently enacted Miller-Tydings resale price fixing law may mean abandonment of the pending price cases before the Federal Trade Commission, one of which is the complaint against automobile parts manufacturers and jobbers.

Although officials are reluctant to discuss the matter and will not commit themselves definitely except to say that the pending price cases are being studied in the light of the new law, it is known that Chairman Ayres and other FTC commissioners are worried that the new law gives approval to practices against which the commission has complained. It is believed that some of them will have to be thrown overboard.

The pending automobile parts case involves five trade associations including the National Standard Parts Association and the Motor and Equipment Wholesale Association, both national organizations. Other associations cited are regional trade groups. All are charged with combining to control the market and fix resale prices of their products.

Pierce-Arrow Plans Approved

Stockholders of Pierce-Arrow Motor Corp., Buffalo, N. Y., approved a plan of recapitalization and reorganization at a meeting Sept. 2.

Purpose of the new financing is to raise funds for the production of a new car to sell around $1,200. President A. J. Chanter said at the meeting that the production schedule initially calls for the manufacture of about 1200 of the present high-priced cars, 25,000 of the new medium-priced line and 4800 trailers.

"Customer Relations"

(Continued from page 297)

"As soon as letters are received they are read and classified as to type. There are six general classifications under the headings of favorable replies; unfavorable replies; dealer comments; suggestions; multiple owners and long mileage.

"Each of these has a number of subdivisions and a symbol. Under the general heading of favorable replies there are ordinary favorable replies, copies of which are sent to the regional and zone office where the owner lives, and to all department heads of the central office. Usually good replies call for additional copies which go to the chief engineer, plant manager and the advertising agency.

"Then there are letters asking for information on matters of sales, finance and service.

"Under the head of unfavorable replies are two divisions: product complaints and dealer complaints. Nine copies of these letters go to various heads of the central office service department, as well as the field service man covering the territory where the owner lives, for immediate investigation and action.

"Under the general head of dealer comments a record of all remarks, both favorable and unfavorable, is kept on cards and filed, thus providing a report on every dealer in the country.

"Suggestions from owners are copied on cards, copies of which go to the general manager, general sales manager and chief engineer. Also, cards are made and filed for all purchasers of five or more Pontiac cars and cards are made for every owner who states that he has driven his car 50,000 miles or more."

Sales "Happy Surprise"

(Continued from page 295)

10,654 units, with dealers stocks reduced to 27.8 days supply.

Graham-Paige Motors Corp. will advance retail prices from $35 to $50 on September 15, according to announcement by Robert C. Graham, executive vice-president. "In common with the rest of the industry," said Mr. Graham, "we find the increased cost of labor and materials will make necessary a revision of our price schedule.

An increase in retail deliveries over June is shown in Graham's July reports received from dealers, according to announcement by F. R. Valpey, vice-president and general sales manager. "Our dealers report 1443 retail deliveries in July, which is 143 more units than we delivered in June, and within 124 units of May, which was the largest retail month this year," Mr. Valpey said.

Decide on Tools

As a step in Chevrolet's program for development of service to Chevrolet owners, dealer service managers from every zone in the United States have just concluded their second annual tool conference. In selecting necessary tools and equipment to service Chevrolet properly, these men, actively at work in the field, were assisted in their studies of proper mechanical equipment by central office executives. C. W. Wood, national director of service, conducted the various sessions.

National Air Races Open

Latest in Engines, Planes Seek New Speed Marks

On the eve of the opening of the National Air Races at Cleveland when the newest in radial and in-line engines and the latest in airplanes will be tested, Keith Rider, a leading designer of racing planes, announced that he would turn to the automobile race track for the engine to be used in his 1938 racing ship. Rider will use an engine built by Harry Miller, builder of the Miller Specials which have set many speed records. Rider also announced the completion of designs for "flivver" planes for private use, to be powered by Ford V-8 engines.

The air races will get under way with the Bendix Transcontinental Trophy Race from Los Angeles to Cleveland Sept. 3, and will reach a climax with the Thompson Trophy Race, aviation's speed event, on Labor Day at Cleveland. Speeds of over 300 m.p.h. are expected in the Thompson race.

Radial engines will be used in both races by Roscoe Turner and Frank Fuller, San Francisco sportsman pilot. In-line engines will power the planes of S. J. Wittman, Art Chester, Marion McKeen and Roger Don Rae.

Unusual Plane

One of the most unusual ships entered in the Bendix race is an entirely new design recently completed by Bellanca for Capt. Alex Papana of the Roumanian Royal Flying Forces. The design, originated by Captain Papana himself, consists of a Roger V-12 engine in the nose of the ship with a Menasco in-line engine mounted on each wing. Performance of the strange ship will be watched with keen interest by aviation engineers and designers. After the Bendix race, Captain Papana announced plans for a trans-Atlantic flight in his new ship to Bucharest with a stop scheduled at Paris. He will fly solo and expects to make Paris in 16 hours from New York.

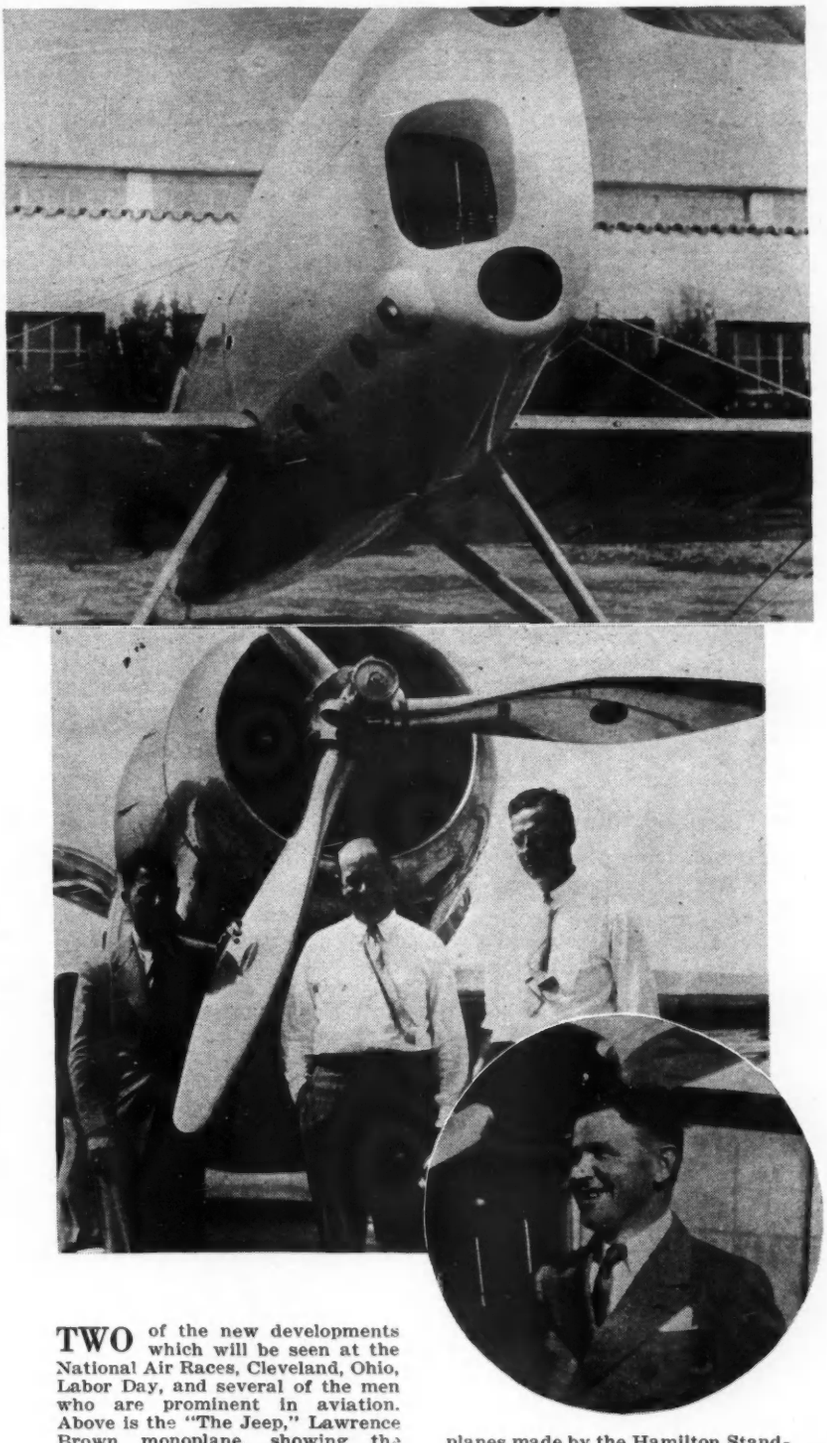
Also attracting much attention is the "mystery ship" entered by Frank W. Fuller in the Bendix and Thompson races. It is an adaption of the Seversky fighting ship built for the U. S. Army with a lower cockpit, plexi-glass housing and a shortened wing spread. The design is a Seversky SE V-2 powered with a Pratt & Whitney twin row Wasp Senior developing 1200 hp. for the takeoff. It is equipped with a three-blade propeller made by the Hamilton Standard Propeller division of United Aircraft Corp. the latest propeller design for speed racing. Speed of 350 m.p.h. has been claimed at tests in Cleveland prior to the races.

The radically streamlined monoplane built entirely by students of the Delgado Trades School, New Orleans, has not been discounted as a potential winner of the Thompson Trophy. Boys at the school completed the little ship under the supervision and direction of Byron Armstrong, former Schneider Cup designer of American ships in that race and former U. S. Navy flyer. Extreme streamlining of the landing wheel pants gives the plane a unique appearance.

Roscoe Turner has a new ship for this year's races although the famous old "57" which cracked up in the Bendix last year has been rebuilt and will be flown by Lieut. Joseph Mackey. The new ship is a Brown Racer powered with a Pratt & Whitney engine of 1830 cu. in. displacement.

Among the special prizes is one of $2,000 to the winner of the Thompson Trophy Race provided a new average speed record is made. It was given by

(Turn to page 303, please)



TWO of the new developments which will be seen at the National Air Races, Cleveland, Ohio, Labor Day, and several of the men who are prominent in aviation. Above is the "The Jeep," Lawrence Brown monoplane, showing the cowling which covers the entire inverted engine, and the air intake ports. It uses a Menasco C4S engine. In the center is shown the mounting of the new Pratt & Whitney twin-row Wasp Senior on the new Seversky "mystery ship" and the new three-blade propeller for racing planes made by the Hamilton Standard Propeller division of the United Aircraft Corp. Standing in front of the plane, left to right are Clifford Henderson, director of the National Air Races, Frank W. Fuller and Dwight Joyce, sportsman pilots. Below is A. S. Menasco, engine designer and builder.

Business in Brief

Written by the Guaranty Trust Co., New York

Business Level Steady

General business activity held up well last week. The weekly index compiled by the *Journal of Commerce* stood at 102.4, as compared with 102.6 the week before and 91.2 a year ago. Although the domestic business outlook is regarded as favorable in many quarters, there is some concern over developments in the Far East.

The index of business activity compiled by the Guaranty Trust Company for July stood at the preliminary figure of 96.3, as against 95.1 the month before and 89.0 for the corresponding period last year. The company's index of wholesale commodity prices at the middle of August was 86.5, as compared with 87.5 a month earlier and 73.2 a year ago.

Railway freight loadings during the week ended August 21 totaled 781,247 cars, which marks an increase of 3,865 cars above those in the preceding week, a rise of 45,771 cars above those a year ago, and a gain of 155,473 cars above those two years ago.

Power Output Peaks

Production of electricity by the electric light and power industry in the United States during the week ended August 21 continued at a record pace and established a new all-time high. The volume of output was 10.0 per cent above that in the corresponding period last year.

According to the Board of Governors of the Federal Reserve System, the volume of production and distribution during July showed little change from the level in the preceding month. The board's seasonally adjusted index of production stood at 114 per cent of the 1923-25 average, as compared with the same figure for June and 118 for May.

Production of lumber during the week ended August 14 stood at 80 per cent of the 1929 weekly average. Output was 25 per cent greater than new orders booked and 15 per cent above shipments.

Fisher Index

Professor Fisher's index of wholesale commodity prices for the week ended August 28 stood at 91.7, as compared with 91.9 for both the week and two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended August 28 showed an increase of $1,000,000 in discounted bills. Holdings of bills bought in the open market and Government securities remained unchanged. Money in circulation declined $5,000,000, and the monetary gold stock increased $14,000,000.

Company Earnings

General Motors Acceptance

General Motors Acceptance Corp. reported net income for the first half of the year of $6,380,919 against $6,711,440 for the like portion of last year. No provision was made for surtax. Gross income was $23,760,250 against $21,937,052 and expenses were $12,505,769 against $11,448,020.

Continental Motors

Continental Motors Corp. reported for the quarter ended July 31 net income of $53,463 before deductions for Federal income taxes, against a net loss of $53,849 for the like period last year. For nine months ended July 31 the company reported net income before taxes of $88,081, against a net loss of $159,025 for the like portion of the preceding year.

Car Radio Programs

To Be About as Numerous As Year Ago; Rates Up 10 P.C.

Although Ford Motor Co. has decided to drop its sponsorship of the World Series this year, fall and winter automotive radio programs will be about as numerous as last season's, the National Broadcasting Co. and the Columbia Broadcasting System told AUTOMOTIVE INDUSTRIES. Ford has dropped one of its weekly half-hour periods on the Columbia chain, but will continue its hourly and another half-hour program—these on 95 stations.

Columbia's Chrysler, with Major Bowes' Amateur Hour, will be heard on a few more stations, a total of 93, Pontiac's Kathryn Cravens has been expanded to a larger hook-up, and Nash will take over the Prof. Quizz program heretofore sponsored by Kelvinator. Chevrolet returns to the air on Sept. 26 over 97 stations, the largest hook-up the company has ever used.

NBC has contracted to put on a larger show than ever for the Pontiac "Varsity" broadcast, and Packard will be back on the air after the summer lull with the biggest program in its history, featuring Lanny Ross. General Motors concerts will be continued probably on a larger hook-up of stations, and Buick will continue to broadcast important fights, such as the battle between Joe Louis and Tommy Farr. NBC is confident that Studebaker will be back on the air, although the company has not signed up.

Firestone and other tire companies, and gasoline company programs will again be as strong, with some indications of larger hook-ups and more expensive programs, NBC and Columbia say. Rates on the air are about 10 per cent higher this year than last.

Black Leads Car Colors

Black still leads all other colors for automobiles in popularity although it is not nearly so far in the lead as it used to be, says William R. Tracy, vice-president in charge of sales, Hudson Motor Car Company.

"For the first time in our history a color other than black led the procession up to the first of January on our 1937 cars, but since that time black has regained the lead," said Mr. Tracy. "Its margin of popularity is not what it used to be, however. The color that led black up to January 1, was gun-metal gray. At that time we had used 30,855 gal. of the gun-metal lacquer as compared with 29,500 of the black.

"Up to August 21, however, the picture has changed and black was again ahead with 73,493 gal. as compared with 64,935 of the gun-metal."

July Car Registrations Up

New car registrations for all states with the exception of Wisconsin during the month of July amounted to 357,530 as compared with 348,131 for the same states during July, 1936, an increase of approximately 2.5 per cent. Due to recent legislation enacted in Wisconsin, the publication of new car registrations in that state is prohibited by law.

This is the first month since March, 1937, that the new car registrations have shown an increase over the same period a year ago. Of the total registrations in this same group of states, Ford accounted for 83,188 as against 79,703, Chevrolet 73,910 as compared with 95,883 a year ago and Plymouth for 48,586 as compared with 50,507.

Complete data on new registrations by makes will be shown in tabular form in next week's issue.

Paddle Blower Wheel

The addition of a paddle type blower wheel to its line of aluminum blower wheels has been announced by The Torrington Manufacturing Company, Torrington, Conn. Originally designed for automobile windshield defrosting these wheels have many additional applications. They are being used for automobile heaters, small hand hair dryers, air circulators in ice box refrigeration and in other cases where a small air delivery is required. The paddle type blower wheels are being manufactured in three sizes—2 in. 2½ in. and 3 in. Each unit is equipped with seven aluminum blades, brass hub and set screw. Wheels are suitable for either clockwise or counter clockwise rotation. Standard bore is ¼ in. Nickel or cadmium plate or dip lacquer (black) finishes are available at slightly higher prices.

. . . *slants*

NO PARTS—*The Department of Commerce's field operatives report that Iran is almost completely bare of spare and replacement parts for cars, buses and trucks, and that as a result hundreds of vehicles have had to be taken from the roads. The department's observer said that orders for parts are being placed and that it was hoped that by the end of 1937 the situation would be relieved. The situation arose from the plan of the government to monopolize the sale of automotive products. It did not work and three new companies, with capital belonging to former dealers, are now beginning to function.*

TYPICAL TOURIST—*What the average person asks for when he wants touring information and how he tours is told by Esso Touring Service, which has just received its millionth request for such data. Eighty-one per cent of the inquiries come from men who generally use prepared post cards and put their requests in very brief terms. The average motorist returns home by a different road than that which he took going out. He takes his trip on his vacation and likes to drive 250 miles each day. Trips average 1200 miles. Tourists are vague on what constitutes "points of interest" to visit, but almost all ask for data on them. Ten per cent of the inquiries are for directions to Niagara Falls, but the average man*

does not state he wants to honeymoon there. Women do. Only 1 per cent of the tourists want to see the Dionne "quints." Motorists are very specific in wanting to know the times and costs for ferry trips. Over 31 per cent of the requests demand prompt replies.

UNUSUAL MIXTURE—*Half a dozen curtain rods, three old airplane wheels, one well-used range stove cleaner, the gasoline tank from a 30-year-old stationary engine and one ancient engine were the materials used in the hand manufacture of a farm tractor by a Regina, Sask., farmer. He used a hack saw, hand drill and file. The tractor works so well that the farmer is selling his team of horses.*

New Air Compressor

Ingersoll-Rand Co. has developed a new self-contained air compressor for mounting on motor trucks. It is entirely independent of the truck engine and transmission. Dimensions are 6 ft. 7 in. by 2 ft. 3½ in. making feasible crosswise mounting to take up as little loading space as possible. The unit weighs 2100 lb.

Driven by a Waukesha four cyl. engine fitted with oil bath air cleaner, high tension magneto and "airsealed speed controller," the unit includes a two cyl. vertical, single-acting, two-stage, air-cooled compressor. Starting is accomplished through a standard 6-volt motor run from the truck batteries, but a 6-volt generator can be supplied as an option. The coupling between engine and compressor is an internal expanding, toggle-type, three-sector, hand operated "Fawick" clutch. Capacity at 100 lb. pressure is stated as 85 cu. ft. per min.

The unit is provided with a lifting bale for ease in removing to the ground or transferring to another truck.

Hose reel mountings are optional equipment.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

Carbonic Acid Carriage Motor

The New Power Co., who own the patents of the carbonic acid motor invented by Lewis B. White, have started a factory on Meade Street, Trenton, N. J., and are building their first lot of motor carriages. . . .

The liquid gas is to be stored in the tubular frame of the vehicle and maintained at a standard temperature of 90 degrees . . .

The motor, which weighs but 70 pounds, and is said to generate fifteen horse-power, is placed on the frame and connected with the rear axle by means of a telescope rod. The motor runs as high as 2,000 revolutions per minute, and is controlled like a locomotive.

The difficulty hitherto experienced with carbonic acid gas, when used for power, has been that the rapid evaporation would cause the valves to freeze. This difficulty the company claims to have overcome through a new valve which positively cuts off the current from the retaining cylinder at every stroke.

From *The Horseless Age*, Sept., 1897.

Bureau Backs Rear Engine

Recognizing that the modern streamlined automobile marks an improvement both in appearance and reduced wind resistance over older types, the Bureau of Public Roads has reported to Congress that "the high hood" of such bodies limits the drivers' view and is "a serious defect" which could be eliminated "by placing the engine in the rear."

"The same change," the bureau said, "would probably also relieve the occupants of some noise, heat and odor, and permit lowering of the floor boards —all desirable in the interest of safety."

The report added, however, that "satisfactory maneuverability of the car requires an almost equal distribution of weight to the front and rear wheels, and to accomplish this in a rear-engined car of reasonable wheelbase will require an engine about half as heavy as present units." Such a rear-engined car "with acceptable handling characteristics" must await powerplant and drive developments, according to the Bureau.

Discussing the all-steel body with its "stiffer frame" of "light metal," the bureau pointed out that such construction "provides much greater strength without corresponding increase in weight and is therefore a great advance in the direction of safety."

These recommendations were included in a section on automobile design in the recent highway safety and traffic report sent to Congress shortly before adjournment.

July Truck Output Over 1936

Passenger Car and Truck Production

(U. S. and Canada)

	July 1937	June 1937	July 1936	Seven Months 1937	Seven Months 1936
Passenger Cars—U. S. and Canada:					
Domestic Market—U. S.	341,089	387,121	358,102	2,477,671	2,285,279
Foreign Market—U. S.	19,186	24,273	13,820	169,562	128,105
Canada	12,513	17,919	7,901	109,336	92,866
Total	372,788	429,313	379,823	2,726,569	2,506,250
Trucks—U. S. and Canada:					
Domestic Market—U.S.	61,174	66,317	58,113	465,547	431,591
Foreign Market—U. S.	17,385	19,587	10,696	114,903	84,316
Canada	5,428	5,922	2,574	37,176	23,557
Total	83,987	91,826	71,383	617,626	539,464
Total—Domestic Market—U. S.	402,263	453,438	416,215	2,943,218	2,716,870
Total—Foreign Market—U. S.	36,571	43,860	24,516	284,465	212,421
Total—Canada	17,941	23,841	10,475	146,512	116,423
Total—Cars and Trucks—U. S. and Canada	456,775	521,139	451,206	3,344,195	3,045,714

Passenger Car Production by Wholesale Price Classes

(U. S. and Canada)

	Seven Months 1937	Seven Months 1936	Per Cent Change	Per Cent of Total 1937	Per Cent of Total 1936
Under $500	1,302,751	1,366,071	− 4.5	47.26	54.51
$501 to $750	1,333,021	1,026,260	+30.0	48.36	40.95
$751 to $1000	88,884	79,292	+12.1	3.22	3.16
$1001 to $1500	22,218	25,539	−12.8	.81	1.02
$1501 to $2000	7,536	6,120	+23.0	.27	.24
$2001 to $3000	2,035	2,733	−25.4	.08	.11
$3001 and over	124	235	−47.2	....	.01
Total	2,756,569	2,506,250	+10.1	100.00	100.00

Truck Production by Capacities

(U. S. and Canada)

	Seven Months 1937	Seven Months 1936	Per Cent Change	Per Cent of Total 1937	Per Cent of Total 1936
1½ Tons and less	578,982	505,029	+14.5	93.75	93.62
2 to 3 Tons	23,677	23,190	+ 2.1	3.83	4.30
3½ Tons and over	7,714	4,821	+60.0	1.25	.89
Special and buses	7,253	6,424	+12.9	1.17	1.19
Total	617,626	539,464	+14.7	100.00	100.00

Automotive Metal Markets

War Conditions and Preparations Beginning to Have More Effect on Prices; Tungsten, Antimony Advance

While the Sino-Japanese hostilities and the European armament race have so far had relatively little effect on the markets for the major metals that enter into automotive consumption, a sharp advance in the price of tungsten, used extensively in automotive die materials as well as in ignition contact disks, comes as a reminder that the American consumer foots in part a good share of the world's war bills.

The market for tungsten ore (Chinese wolframite) was quoted this week at around $28 @ $32, compared with $24 earlier in the month and an average price of $15.50 last year. Prices would have gone still higher, were it not that tungsten stocks in the United States are apparently fairly adequate for nearby needs.

The market for antimony, used in white bearing metals, is also affected by the dislocation of conditions in the Far East. While some antimony is produced in the United States, imports from China are of paramount importance. Prices have advanced 10 per cent since the outbreak of the undeclared war.

From some of the steel-making districts mild improvement in the volume of specifications received from automotive consumers is reported, but on the whole, the placing of worthwhile commitments is still in abeyance and little in the way of a quickening of the demand is expected before the middle of the month. A heartening symptom is that cold-finished steel bars come in for better buying interest than was the case a few weeks ago.

Middle West markets report marked betterment in pig iron buying by automotive foundries, nearly all of it for September shipment.

Outstanding among the week's developments in the copper market was a recession in the export price, the Liverpool c.i.f. quotation at the beginning of the week standing at 13.70 cents. Varying interpretations are placed on the break of export prices through the 14-cent level. Some copper interests say that there was considerable buying abroad early in August in the expectation of an advance here. Now these foreign buyers can look on and wait for a further recession before resuming buying. Others ascribe the break in the export price to uncertainty and the resulting apathy. Buying here is almost entirely made up of transactions between producers and their own fabricating subsidiaries. Secondary refiners have reduced their scrap buying prices by ⅛ cent.

Spot Straits tin was quoted at 58¼ cents at the beginning of the week, with consuming interest almost entirely absent. Sterling exchange was slightly lower and made for an easier tone. London sentiment veers toward aloofness until Far East conditions can be better appraised. The market advanced fractionally on Tuesday to 58¾ cents, without, however, showing any definite change in the trend.

W. C. H.

GM Plans Dealer Meetings

Ten thousand General Motors dealers will hold simultaneous meetings in more than 60 cities on Sept. 15 to hear the company's chief executives explain the operation of its dealer council plan, it is understood. The dealers will be addressed by a nationwide telephone hook-up from the Chicago meeting, which will be attended by A. P. Sloan, Jr., chairman of the board, William S. Knudsen, president, and R. H. Grant, vice-president in charge of sales.

General Motors executives already meet three or four times a year with 48 dealers selected from various sections of the country and discuss matters of policy. One division, Chevrolet, carries this idea much further and holds monthly meetings. It was regarded as probable in some quarters that General Motors as an institution might enlarge on its own program.

Hupp Preview Is Held

A new landmark for Detroit, one of the largest Neon signs in Michigan, was illuminated Sept. 2, at the Milwaukee Ave. plant of the Hupp Motor Car Corp. to mark the 30th anniversary of the company. The new sign will display four 30 ft. letters said to be visible at night along air lanes for a distance of 75 miles.

Hupp celebrated its 30th birthday with a special preview party for newspaper representatives and magazine editors from leading cities.

MEMA Index Down in July

Grand index of the Motor and Equipment Manufacturers Association fell seasonally from 174 in June to 148 in July, but was above that for July, 1936, which was 136. All divisions excepting accessories shipments to wholesalers were down, that climbing from 99 to 116 against 88 a year ago. Original equipment shipments to vehicle manufacturers dropped from 190 to 153 against 145 a year ago. Service parts shipments to wholesalers dropped from 167 to 154 against 148 a year ago. Service equipment shipments to wholesalers dropped from 154 to 127 against 109 a year ago.

New Passenger Car Registrations*

* For July the gain over the same month of last year was 2.5 per cent, while for the first seven months of the year, the increase over 1936 was 6.9 per cent. The figures exclude Wisconsin registrations for July in both 1937 and 1936, for comparative purposes, because a new law in that state prohibits monthly release of data.

	JULY 1937	JUNE 1937	JULY 1936	SEVEN MONTHS 1937	SEVEN MONTHS 1936	Per Cent Change, 7 Months, 1937 over 1936	Per Cent of Total Seven Months 1937	Per Cent of Total Seven Months 1936	NINE MONTHS 1937 Models	NINE MONTHS 1936 Models	NINE MONTHS Per Cent Change
Ford	83,188	85,113	79,703	575,592	495,475	+ 16.2	24.45	22.51	666,653	606,652	+ 10.0
Chevrolet	73,910	70,353	96,883	485,800	625,126	− 22.4	20.64	28.40	629,453	746,347	− 15.7
Plymouth	48,586	48,461	50,507	312,134	310,517	+ 0.7	13.26	14.11	401,537	373,369	+ 7.4
Dodge	26,522	26,207	25,270	171,089	155,863	+ 10.0	7.27	7.08	213,327	188,739	+ 13.0
Pontiac	22,846	22,705	18,139	139,324	109,988	+ 26.8	5.92	5.00	171,424	132,408	+ 29.3
Oldsmobile	20,244	21,039	19,023	127,588	127,765	− 0.2	5.42	5.80	151,906	155,333	− 2.2
Buick	20,582	21,172	15,118	124,940	97,118	+ 28.5	5.31	4.41	162,625	122,021	+ 33.0
Packard	8,933	10,074	4,955	66,475	33,658	+ 97.0	2.82	1.53	80,972	42,311	+ 91.0
Chrysler	6,717	9,181	5,612	56,719	36,239	+ 56.4	2.41	1.65	69,040	40,919	+ 68.9
Terraplane	7,919	8,301	8,146	52,134	51,083	+ 2.1	2.21	2.32	65,712	61,082	+ 7.8
Nash	6,722	7,618	4,135	48,420	27,008	+ 79.0	2.06	1.23	56,822	32,282	+ 76.1
Studebaker	6,590	7,040	5,327	47,512	40,791	+ 16.3	2.02	1.85	59,815	46,757	+ 28.0
De Soto	7,582	7,555	5,360	47,213	26,939	+ 75.7	2.00	1.22	56,378	30,698	+ 83.5
Willys	5,993	5,737	1,508	34,816	7,637	+355.0	1.48	.35	36,498	9,848	+271.0
La Salle	3,026	2,957	1,007	18,697	7,268	+157.0	.79	.33	23,169	9,460	+145.0
Lincoln	2,278	2,373	1,297	16,427	7,823	+110.0	.70	.36	20,191	8,795	+130.0
Hudson	1,320	1,593	1,792	10,294	14,107	− 27.0	.44	.64	13,660	18,275	− 25.2
Graham	1,406	1,404	1,873	9,080	10,365	− 12.4	.39	.47	11,618	12,197	− 4.5
Cadillac	952	1,131	1,005	7,689	7,079	+ 8.7	.33	.32	10,043	9,264	+ 8.0
Cord	137	136	147	834	715	+ 16.5	.04	.03	972	715	+ 36.0
Pierce-Arrow	4	6	69	146	474	− 69.2	.....	.02	246	630	− 60.9
Auburn	3	3	148	139	1,437	− 90.3	.....	.07	274	1,945	− 86.1
Miscellaneous	69	77	1,107	825	6,673	− 87.6	.04	.30	2,430	8,623	− 71.8
Total	357,531	360,236	348,131	2,353,887	2,201,148	+ 6.9	100.00	100.00	2,904,765	2,658,670	+ 9.2
Chrysler Corp.	91,407	91,404	86,749	587,155	529,558	+ 11.0	24.94	24.06	740,282	633,725	+ 16.9
Ford and Lincoln	85,466	87,486	81,000	592,019	503,298	+ 17.8	25.15	22.87	686,844	615,447	+ 11.5
General Motors	141,560	139,357	151,175	904,038	974,344	− 7.1	38.41	44.26	1,148,620	1,174,833	− 2.5
All Others	39,098	41,989	29,207	270,675	193,948	+ 39.1	11.50	8.81	329,019	234,665	+ 40.1

Sees Prices Up Again

(Continued from page 295)

ger cars to any extent, Mr. Sloan said, although General Motors is building Diesel engines for marine use in its Winton engine plant in Cleveland, and for trains and other industrial uses in its Electro-Motive plant at La Grange, Ill. Recently the corporation began a new building in Detroit to build trucks for Diesel powerplants.

"Very good" was Mr. Sloan's opinion of the overseas business of the corporation. More cars could be sold in Germany and England, and probably in other European countries, if the difficulties in getting materials and parts were not so great.

National Air Races Open

(Continued from page 299)

the Ludlum Steel Co., Watervliet, N. Y.

Rider said his new 1938 racing planes will weigh in all only 1600 lb. This would make them one-third as heavy as one of the four racers of his design which compete in this year's National Air Races. The new automobile-type engines to be built by Miller will be V-16's of 850 hp. and will turn up to 7000 r.p.m. Rider's present planes have 1200 hp. engines but only 2500 r.p.m.

"In the past, racing planes have used commercial motors 'souped up' for added power," Rider said, "I plan to use a strictly racing type engine next year." The new racer will be built of wood to allow more perfect molding of wings and fuselage. It will carry retractable landing gear, wing flaps and hydraulic wheel brakes.

Rider said that before arriving in Cleveland for the races he had completed a series of conferences with Ford engineers and officials at Detroit on plans to produce the new "flivver" planes at his plant in Venice, Calif.

Entrants in the Bendix Transcontinental Trophy race include:

Roscoe Turner, Brown Racer, twin-row Pratt & Whitney engine.

Capt. Alex Papana, Roumainian Royal Air Forces, Bellanca, Roger V 12 engine in nose of ship and Menasco engine mounted on each wing.

Lieut. Joseph Mackey, Weddell-Williams.

Frank W. Fuller, Seversky, Pratt & Whitney twin-row Wasp Senior.

Earl Ortman, Marcoux-Bromberg.

In the Thompson Trophy Race are:

Turner, same plane.

Lieut. Mackey, same plane.

Roy Moore, Fuller Seversky.

Earl Ortman, Keith Rider plane.

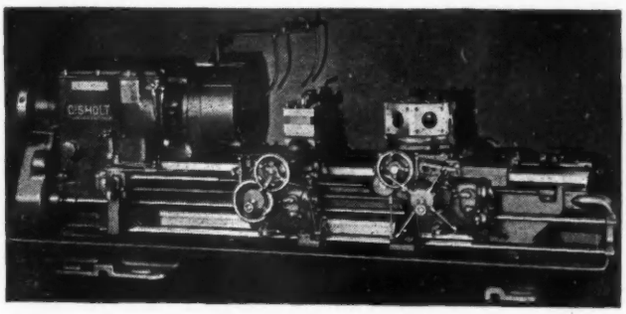
S. J. Wittman, plane of own design, Curtis 12-cyl. in-line engine of 1145 cu. in. displacement.

Clarence McArthur, Delgado Trade School monoplane.

Harry H. Crosby, Glendale, Cal., Refinal Robbins, Fort Worth, Tex., and Robert Perlick, also of Glendale.

Entrants in the Greve Trophy Race for ships with engines limited to 549 cu. in. displacement and in the race limited to ships with engines of 397 cu. in. include, Art Chester, Lee Miles, Roger Don Rae and R. A. King along with numerous beginners.

TOOLS OF TOMORROW



Gisholt turret lathe now available in sizes ranging from 6-in. to 12-in. bar capacity and 21-in. to 32-in. chucking capacity.

Turret Lathes

. . . in sizes ranging from 6-in. to 12-in. bar capacity and 21-in. to 23-in. chucking capacity

Three new turret lathes in sizes ranging from 6-in. to 12-in. bar capacity and 21-in. to 32-in. chucking capacity have been introduced by the Gisholt Machine Co., Madison, Wis. The machines are intended for both large quantity production of similar pieces or small lot jobbing of irregular and varied types of work.

The bed and headstock of these machines are cast in one piece from nickel semi-steel in the Gisholt foundry. Bed ways are of steel, hardened and ground in place.

The 12-speed transmission is of sliding gear construction and has a normal speed range of 12 r.p.m. to 220 r.p.m. for the 3AL model and 142 r.p.m. on the 4L and 5L models. The spindle is mounted on twin tapered roller bearings at the front and a straight roller bearing at the rear. An automatic multiple disc spindle brake stops the spindle quickly when the clutch lever is placed in neutral position. All gear shafts and bearings run in an oil bath and the spindle bearings are continually fed with clean oil from a catch reservoir.

Feeds and rapid traverse are controlled at each carriage entirely independent of each other. The eight reversible feeds are selected at the aprons and range in arithmetical progression from 0.008 in. to 0.250 in. With the change gears provided, this range may be varied from a fine range of 0.004 in. to 0.125 in. to a coarse range of 0.016 in. to 0.500 in., providing a total of 64 available feeds. Feeding is accomplished through separate lead screws for each carriage and the feeds provided permit cutting of all U. S. standard threads from 2 to 32 including 11½. Special change gears may be provided for special threads.

Grinding

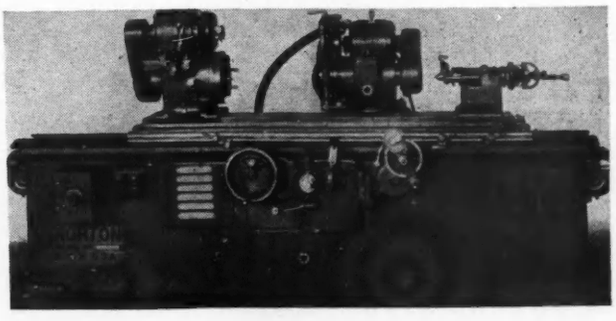
. . . 14-in. multipurpose hydraulic universal machine offered in three lengths

Norton Co., Worcester, Mass., has announced a completely redesigned model of its multipurpose grinder. The machine, with 14-in. swing, is offered in three lengths—36 in., 48 in. and 72 in.

Among the features listed by the manufacturers are: hydraulic power work table traverse, a universal wheel head and work head (the latter being so arranged that either live spindle or dead center are instantly available), force feed lubrication of the table ways and a wheel spindle of large proportions, each bearing being individually and automatically lubricated.

The 48-in. machine illustrated herewith weighs about 8000 lbs., mounts wheels up to 14 in. by 1½ in. for cylindrical grinding or cup type wheels

(Turn to page 323, please)



Norton multipurpose grinding machine with 14-in. swing

AUTOMOTIVE ABSTRACTS

Hp. Correction to Atmospheric Conditions

The logic of horsepower corrections to standard atmospheric conditions is discussed in an article by Georg Blank and Helmut Killing. The correction formula discussed by them makes the horsepower directly proportional to the atmospheric pressure and inversely proportional to the absolute temperature, 736 mm. of mercury and 10 deg. C. (50 deg. F.) being taken as the standard pressure and temperature respectively. This is in contrast to the correction formula used in most other countries according to which the horsepower varies inversely as the square root of the absolute temperature. The authors state that the equipment generally used in dynamometer tests hardly permits of a greater degree of accuracy than ±3 per cent, and they recommend that no correction factor of less than 3 per cent should be applied to the results of dynamometer tests. They took temperature and pressure readings three times a day over a whole year, both in the laboratory and outside, calculated the correction factors from the measurements, and charted and tabulated the results. They found that 93.3 per cent of all the correction factors applying to atmospheric conditions in the laboratory and 57.2 per cent of all applying to the open air were between 0.97 and 1.03. The conclusion reached is that if corrections are entirely neglected the probable error will be only very little greater than that dependent on the equipment used.—*ATZ*, Jan. 25.

Starting Aid for Diesel Engines

As an aid in starting from cold, the small Diesel engine built for passenger cars and light commercial vehicles by the Daimler-Benz Company is provided with what is known as an oil vaporizer, of which an illustration is shown herewith. The device is flange-bolted to the suction line of the engine. It comprises a closed tube a into which is set the heating tube b. At the bottom tubes a and b communicate through the orifice e_1. At the top tube a widens into the reservoir a_1 to whose cover the leakage return tube 11 7721 from the injection nozzle of cylinder No. 4 is connected, so that the reservoir is constantly being supplied with fuel. To begin with, the reservoir is filled with fuel through the opening closed by screw 11 9231. Any excess of leakage fuel runs over into the suction pipe through the short tube i. The leakage fuel entering the heating tube b through orifice e_1, rises in the former to the same height as in the reservoir a_1. Heating tube b is connected by means of terminal g and through the starter switch to the car battery, and is insulated or shielded against cooling influences by the protective tube c, so that when the starter is switched on, the heat generated by the passage of current through the heating tube is used solely for heating the oil, causing it to vaporize.

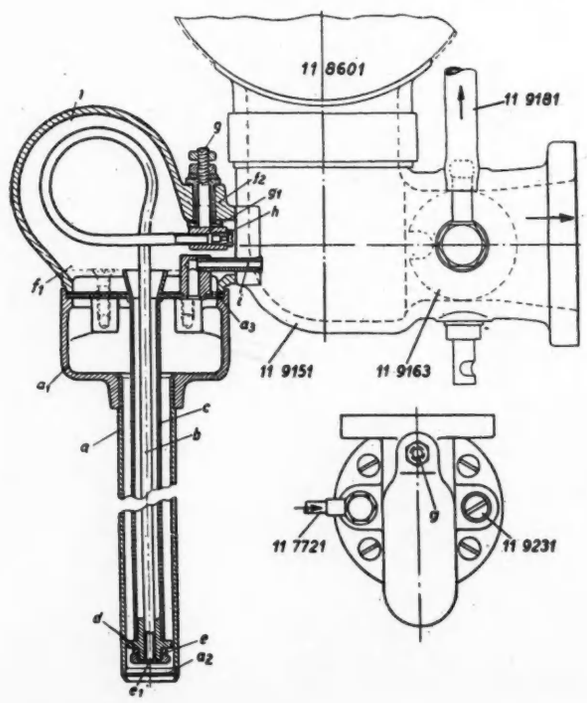
If now the starter button is pressed down all the way and the engine is cranked over, the fuel vapors are drawn from tube b through the nozzle h into the suction pipe, and they enter the cylinders with the fresh air. This is said to assure immediate starting of the engine.

Running out of Diesel fuel on the road is particularly annoying, for one reason because filling stations handling Diesel fuels are not so numerous, but mainly because if the fuel becomes exhausted, air gets into the system and every part of it must be vented before the engine will operate properly again. To prevent such mishaps, in the Mercedes-Benz installation the tank gage is combined with a red warning light which lights up automatically when the fuel supply drops to about 1.5 gals.—*Dienst am Auto.*

Brake Performance

In a lengthy paper on "Brake Performance" the characteristics of various types of friction linings are discussed, among other topics.

(Turn to page 327, please)



Oil vaporizer for cold starting of Diesels.

Rules on Trailer Camps

Trailer camps located within city and town limits were outlawed for the first time in the United States by a court, in the case of Carl Spitler vs. Munster, Indiana. Circuit Judge T. Joseph Sullivan, sitting at Crown Point, Indiana, dissolved a restraining order against the enforcement of a Munster ordinance prohibiting establishment of trailer residences for more than 30 days, and also denied a permanent injunction.

The court upheld the town's right to govern trailer camps and cited the failure of the Indiana legislature to pass laws regulating trailer camps. The court pointed out that trailer camps raise problems of policing, schooling, sanitation and taxes, which the town had a right to regulate.

Scooters for Fair

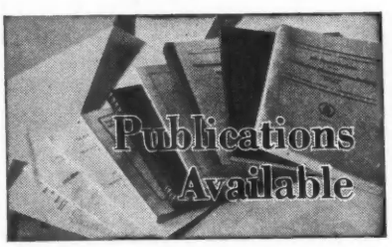
Scores of motor powered scooters will "putt-putt" over the 400-acre grounds of the Golden Gate International Exposition at San Francisco in 1939, according to the concessions division which has made arrangements to have this type of conveyance available to visitors. These gasoline powered conveyances, capable of a speed of 40 m.p.h., will furnish a rapid means of transportation to spectators and exposition officials over the vast areas devoted to the exposition.

Polish Car Imports Rise

Imports of automotive vehicles into Poland in the first six months of the present year totalled approximately 3800 units and exceeded the total imports for the full calendar year of 1936, according to a report to the Department of Commerce from American Trade Commissioner Jule B. Smith, Warsaw. Increased imports in the current year were due primarily to the local assembly of several well-known American makes of cars and one German-American vehicle, the report states.

Studebaker Gets Order

Studebaker Corp., South Bend, Ind., will furnish Bender Body Co., Cleveland, O., with chassis for mounting Bender hearse and ambulance cars under an exclusive sales contract effective Sept. 16.



Progressive Welder Co., Detroit, has issued a **catalog** on its new hydraulic, self-stripping punching unit.*

The Pan American Union, Washington, D. C., has published a **review** of automobile and highway conditions in South America. It is bulletin No. 64.

Proceedings of the 41st annual convention sessions of the American Foundrymen's Association, 222 W. Adams St., Chicago, have been reprinted. The price is $1.00 per single copy.

Fairbanks, Morse & Co. has issued a new bulletin, No. 3600-A2, describing and illustrating the construction and uses of its Model 36-A **Diesel generating sets.***

"The Program of the Automotive Safety Foundation," an **address** by the foundation's president, Paul G. Hoffman, of the Studebaker Corp., has been reprinted. *

Complete data bulletin on pipe, fittings, valves and fume duct have been published by the Haveg Corp., Newark, Del., makers of **model plastic products.***

W. F. and John Barnes Co. has issued a circular on the company's **piston feed pump.***

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Letters

to AUTOMOTIVE INDUSTRIES

Barometric Pressure Data

Mr. Harrison's article on "Standard Atmosphere and Sea-Level Pressures"* interested me very much.

The values that we have been using for correcting Diesel engine performance at various altitudes were taken from the D. E. M. A. curve sheet No. 3 (1930) for normal barometric pressures. Some time ago I worked out these values theoretically on the basis of the ana ysis given in Roberts' "Heat and Thermodynamics" (1928), page 62, with the further assumption that the average temperature drops from 59 deg Fahr. at sea level at the rate of 2 deg. Fahr. for every 1000 ft. elevation. Marks' handbook, 3rd edition, page 1293, Table 25 and page 1528, Table 8 also gives information on this subject. The comparison with Mr. Harrison's results is interesting. The various values are tabulated below.

Marks' Table 8 shows an average temperature decrement of 3.5 deg. per 1000 ft. elevation where a 2 deg. decrement was used to obtain the theoretical values. Marks' Table 25, the theoretical values and Mr. Harrison's results show remarkable agreement up to 3000 ft. Does Mr. Harrison have values of the normal barometric pressures above 3000 ft.?

K. E. BISSHOPP,
Beloit, Wis.

Elevation in ft.	Marks' Table 25	Marks' Table 8	Temp. Deg. Fahr.	Theoretical 2 deg. /1000 ft.	D.E.M.A.
0	29.92	29.92	59.0	29.92	....
1000	28.85	28.84	55.4	28.85	....
1500	....	....	...	28.33	28.32
2000	27.82	27.83	51.9	27.82	27.80
3000	26.82	26.78	48.3	26.81	26.76
4000	25.85	25.79	44.7	25.83	25.76
5000	24.92	24.83	41.2	24.88	24.80
6000	24.00	23.94	37.6	23.96	23.87
7000	....	23.04	34.0	23.07	22.97
8000	22.17	22.17	30.5	22.20	22.11
9000	....	21.33	26.9	21.36	21.26
10000	20.34	20.53	22.3	20.54	20.50
11000	....	....	...	19.75	19.75
12000	19.30	10.00	16.2	18.99	19.01

Editor's Note: L. P. Harrison's article to which our correspondent refers was published in the Aug. 14 issue of AUTOMOTIVE INDUSTRIES. Mr. Harrison gave values of barometric pressures in inches of mercury corresponding to heights above sea level in feet as follows: 29.92 in., 0 ft.; 28.86 in., 1000 ft.; 27.82 in., 2000 ft.; 26.81 in., 3000 ft.

AUTOMOTIVE INDUSTRIES

Looks Ahead

SELF-SHIFTING transmissions will be a big topic in late 1937 and early 1938, with the advent of the new cars. Buick has put over $4,000,000 into a new plant to build them, a plant so new in tooling that it stands out even against the background of the fastest moving industry in the world. The whole story —next week.

DESCRIPTIONS of 1938 cars begin to trickle into the magazine next week also. So far as we are concerned the program of descriptions will be distinguished by more detail, more specifications and more drawings and photographs of important components. Hope you like it.

Plant Notes

The Clark Controller Co., Cleveland, Ohio, has let contracts to the J. L. Hunting Company, general contractors, for a second story addition containing 1200 sq. ft. The addition will be of brick and steel construction and the new space will provide more room for the development, research, and engineering departments. The addition was made necessary by the pick-up in demand for electrical control equipment. This follows closely on the heels of another two-story brick steel and concrete addition of about 800 sq. ft., also built by J. L. Hunting Company, which will provide more space for the spray painting department.

The St. Louis branch of the Behr-Manning Corporation, Troy, N. Y., has taken a long-term lease covering the entire sixth floor of the Francis Building. The move was made necessary by a need for additional space which could not be supplied in the former location. The new space comprises nearly 13,200 sq. ft., which is almost double the amount formerly occupied.

Bantam Gives Lamp Order

In addition to material orders recently announced, The American Bantam Car Company states that contracts have been placed with Corcoran-Brown, Cincinnati, O., for specially designed headlamps for the new American Bantam trucks and autos.

Calendar of Coming Events

DOMESTIC SHOWS

New York, National Automobile Show, Oct. 27-Nov. 3
Toledo, O., Automobile Show. Oct. 27-Nov. 3
Boston, Mass., Automobile Show, Oct. 30-Nov. 6
Los Angeles, Cal., Automobile Show, Oct. 30-Nov. 7
San Francisco, Automobile Show, Oct. 30-Nov. 7
Cincinnati Automobile Show. Oct. 31-Nov. 6
Akron Automobile Show .....Nov. 6-12
Brooklyn Automobile Show.....Nov. 6-13
Chicago Automobile Show .....Nov. 6-13
Columbus Automobile Show .....Nov. 6-12
Omaha Automobile Show.....Nov. 6-11
Detroit Automobile Show.....Nov. 6-13
Motor Truck Show, 4th Annual, Newark, N. J. .....Nov. 6-12
Newark, N. J., Truck Show.....Nov. 6-12
Buffalo, N. Y., Automobile Show..Nov. 6-13
Indianapolis, Automobile Show....Nov. 6-13
Newark N. J., Automobile Show..Nov. 6-13
Philadelphia Automobile Show....Nov. 6-13
Pittsburgh, Pa., Automobile Show.Nov. 6-13
Baltimore, Md., Automobile Show, Nov. 13-20
Cleveland, Ohio, Automobile Show, Nov. 13-20
Springfield, Mass., Automobile Show, Nov. 14-20
St. Louis, Mo., Automobile Show.Nov. 14-21
Portland, Ore., Automobile Show.Nov. 14-21
Denver, Colo., Automobile Show, Nov. 15-20
Jersey City, N. J., Automobile Show, Nov. 15-20
Milwaukee, Wis., Automobile Show, Nov. 17-24
Kansas City, Mo., Automobile Show, Nov. 27-Dec. 4
A.S.I. Show, Navy Pier, Chicago, Dec. 6-Dec. 11

SHOW BUSINESS

Manager of the National Automobile Show in New York is Alfred Reeves, 366 Madison Ave., N. Y. C. Inquiries concerning all matters connected with the national show should be addressed to him. AUTOMOTIVE INDUSTRIES will be pleased to furnish names and addresses of local show managers on request.

FOREIGN SHOWS

Poland, Automobile Salon (Foire Orientale), Lwow .....Sept. 1-15
Yugoslavia, Automobile Section, Autumn Fair, Ljubljana .....Sept. 1-12
Yugoslavia, Automobile Section, Commercial Fair, Belgrade.....Sept. 11-21
France, 31st International Automobile Salon, Paris .....Oct. 7-17
Great Britain, 31st International Automobile Exposition, London...Oct. 14-23
Czechoslovakian Automobile Show, Prague .....Oct. 16-24
Italy, 10th International Automobile Salon, Milan .....Oct. 28-Nov. 8
Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London...Nov. 4-13
Toronto, Ont., Automobile Show..Nov. 6-13
Great Britain, 36th Scottish International Automobile Exposition, Glasgow .....Nov. 12-20
Montreal, Que., Automobile Show, Nov. 20-27

CONTESTS

National Outboard Championship Regattas, Richmond, Va. .....Sept. 18-19

CONVENTIONS AND MEETINGS

American Chemical Society, Rochester, N. Y. .....Sept. 6-10
International Congress on Carbohydrate Carburants, Rome .....Sept. 10-12
National Trailer Show, New York, Sept. 10-15
S.A.E. Section Regional Tractor Meeting, Akron, Ohio.....Sept. 15-17
American Transit Association, 56th Annual Convention, White Sulphur Springs, W. Va. .....Sept. 19-23
S.A.E. Section Regional Transportation Meeting, Chicago .....Sept. 29-Oct. 1
American Foundrymen's Association Midyear Meeting, Columbus, Ohio, Sept. 30-Oct.
S.A.E. Fuels and Lubricants Regional Meeting, Tulsa, Okla. ....Sept. 30-Oct. 1
National Lubricating Grease Institute, Annual, Chicago .....Oct. 4-5
S.A.E. National Aircraft Production Meeting, Los Angeles, Calif.....Oct. 7-9
American Foundrymen's Association, Regional Conference, Rollo, Mo. Oct. 8-9
National Battery Manufacturers Asso., Chicago .....Oct. 10-12
National Metal Congress, Atlantic City, Oct. 18-22
S.A.E. Annual Dinner, Commodore Hotel, New York .....Oct. 28
American Petroleum Institute, 18th Annual Meeting, Stevens Hotel, Chicago .....Nov. 8-12
S.A.E. National Production Meeting, Flint, Mich. .....Dec. 8-10
American Road Builders' Association, Cleveland .....Jan. 17-21, 1938

Studebaker Equips for 1938

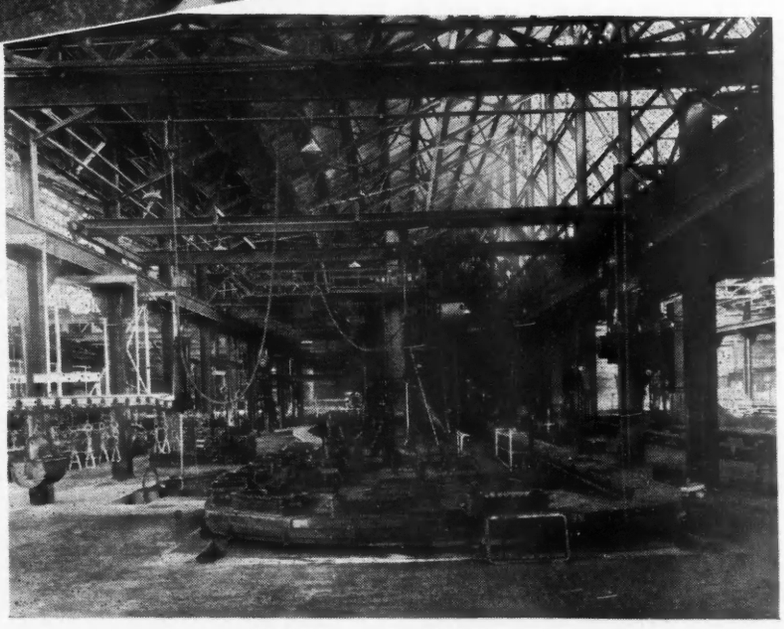
with expenditure of $3,500,000, of which $1,000,000 has been invested in new machines and tools

By Joseph Geschelin

GAGED by the steady rise in sales, Studebaker anticipates a sales volume in 1938 far exceeding its present productive capacity. That in essence is the reason for a comprehensive modernization and equipment program nearing completion as this article was being written.

Rough estimates place the cost of the Studebaker program for 1938 models at around $3,500,000, of which about $1,000,000 represents an investment in

(Above) Eight cutting operations on the main bearing caps are handled on this double ram surface broaching machine. This is a Cincinnati Hydro-broach set up for finishing five faces, the half bore, and oil groove.



(Left) Merry-go-round molding conveyor in Studebaker's modernized foundry. This unit, installed by C. O. Bartlett & Snow, is the cylinder block line No. 2

THIS IS THE SEVENTEENTH IN THE SERIES OF MONTHLY PRODUCTION FEATURES

Distributing conveyor and molders' hoppers feeding the new merry-go-round molding line for the flywheel unit, recently installed by Bartlett-Snow.

(Top) View in body shop showing body shells in white—wet deck station.

new machinery and foundry mechanization; another million new body dies. In retrospect, it is of interest to note that this season's program follows directly on the heels of what happened last autumn when the company razed some 850,000 sq. ft. of old mill type buildings to clear decks for action.

Since the reorganization, Studebaker has adopted a unique manufacturing philosophy in keeping with the nature of the operation, and under the guiding influence of R. A. Vail, vice-president in charge of manufacturing, has bent all its energies to a simplification of methods and procedures geared directly to sales. In the present situation, for example, the objective in adding equipment in the machine shops is primarily that of providing increased capacity rather than emphasizing specialized machinery such as would be required for great volume production.

Stated simply, the problem is one of balancing machine shop capacity with that of other major departments which are capable of turning out 60 units per hour. Consequently, most of the money is being spent on the motor machine shop where the new equipment is about of the same nature as existing machines and is being installed in a line paralleling the present lines. Most of the new machines are required for the cylinder block, crankshaft, and connecting rods. While the changeover is being made, certain operations are being brought in line with the latest practice and both lines of equipment will be completely conveyorized by the installation of a system of gravity roller conveyors.

Coincident with the changes in the machine shop, all major departments are being revamped and cleared for action. Final assembly lines are being completely overhauled.

Important changes have been made in the foundry. Most noteworthy of these is the installation of a Carl-Mayer core oven, replacing the time-honored vertical baking ovens; an entirely new sand handling system; new molding machines and two merry-go-round floor conveyors for facilitating the molding of a variety of small parts. Here, too, will be found one of the new four-station Pangborn shot-blasting machines for cleaning cylinder blocks and a Wheelabrator for tumbling small castings. Both of the latter items produce superior work and at the same time provide worker comfort with complete freedom from occupational hazards usually associated with such foundry operations.

Many of the items of new equipment, as will be evident later, represent the last word in machine shop practice. Prominent among these are the first examples of surface broaching at Studebaker, comprising a number of operations on connecting rods and bear-

Manufacturing Personnel

R. A. Vail	Vice-President in Charge of Manufacturing
P. O. Peterson	Director of Purchases & Stores
Bert Fowler	General Superintendent
J. W. Hines	Asst. General Superintendent
George Westphal	Superintendent Motor Division
R. J. McSherry	Superintendent Foundry
H. Nickerson	Superintendent Car Assembly & Shipping
George Fisher	Superintendent Body Division
R. N. Bucks	Superintendent Power Division
W. J. Learmonth	Superintendent Stampings & Springs
C. E. Floody	Chief Inspector
O. Klausmeyer	Plant Engineer
J. M. Gauss	Manager M and S (Paints & Chemical Lab.)
W. S. Gundeck	Manager Industrial Relations
George Sherman	Manager Transportation
C. Pretz	Manager Truck Division
L. R. Runkle	Chassis Tools & Machine Repairs
A. Eulitz	Chassis Die Making
George Toth	Body Tool & Die

ing caps. Precision boring machines, a new Hutto hydraulic honing attachment for finish-honing, Michigan gear shavers, and interesting machines supplied by Ingersoll, Baker, Greenlee, Sundstrand and others will be described later.

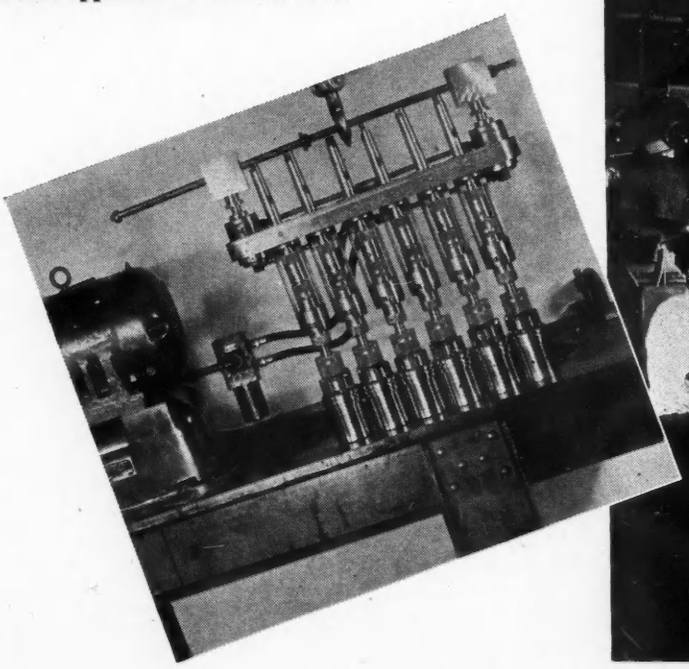
The process of simplifying factory procedures has produced a rather novel organization scheme in which the purchasing department plays an unaccustomed role. Instead of being purely a clearing house for purchase orders and follow-up, the purchasing department has been given full control of all materials handling equipment and personnel and is responsible for receiving, stores, and return goods. Although the primary building schedules are determined by the production department and sales in accordance with orders, once the schedule is established, its performance resides with the purchasing department.

The latter controls, and is responsible for, line setting and has full responsibility for the delivery of raw materials and parts to manufacturing departments and lines. The entire mechanism of ordering materials for schedules—follow-up—return goods routing and replacement—and delivery to the point of use—is concentrated, with no division of responsibility.

It might be emphasized at this point that Studebaker represents a fairly self-contained operation with its own foundry capable of supplying all the castings required for the production of cars and trucks; a complete press shop for producing a variety of sheet metal stampings; a body shop with facilities for body assembly, trimming, and finishing; machine shops; a complete spring manufacturing plant which is essential to an operation requiring many different kinds of springs for car and truck specifications; and an assembly plant housing the final assembly lines.

Materials handling conveyors play an important role in mechanizing and facilitating economical movement of raw materials and sub-assemblies. For size, some of these conveyors will vie

For finish-honing, Studebaker has adopted the newly-designed Hutto hydraulic automatic honing head. Close-up of honing head under test is shown at the side. This is the first production application of the new tool.



Bartlett-Snow car-type molding conveyor for cylinder heads. Foreground is shake-out end showing Simplicity screen.

with any installation in the industry. Here are a few examples:

Fender paint system	4475 ft.
Foundry cooling conveyor, a new 6 in. heavy duty installation	2950 ft.
Motor conveyor, traversing three buildings	3000 ft.
Finish sheet metal delivery	3200 ft.
Final assembly lines	900 ft.

With this introduction, we can examine more in detail the changes that have been made in the various departments. For a visual perspective of what has been accomplished we shall rely upon pictures taken in many corners of the plant.

Machine Shop

As mentioned earlier, the bulk of new mechanical equipment was brought into the motor machine shop so as to increase productive facilities for the coming season. In general, the machines are of about the same type and make as the older machines, although in many instances they incorporate new features. The new machines are arranged to parallel the existing lines so that the work is now routed down two lines of similar character.

A number of surface broaching operations have been adopted for connecting rod and bearing cap machining. The first of these is a Cincinnati double-ram hydraulic broaching machine set-up on the connecting rod for broaching the sides of bolt bosses, bolt seats and nut sets. This is done on the rough forging before the cap is sawed off. This operation removes 3/32 in. of stock from each surface at a ram cutting speed of 41 ft. per min. Number of pieces per hour per machine—360. They hold a tolerance of 0.002 in. on finished dimensions.

From the routing shown elsewhere in this article, it will be noted that after sawing the parting line for the caps, operation 12, rods and caps in pairs are routed to the new double-ram LaPointe hydraulic broach for finishing the mating gasket surfaces. The requirement is that the flat surfaces must "blue" in 90 per cent bearing. Amount of stock removal is 1/64 in. with a ram cutting speed of 24 ft. per min. Productivity of the machine is 360 rods and 360 caps per hour.

Forty-five sets of bearing caps—comprising the crankshaft rear bearing cap, front bearing cap, and two intermediate bearing caps — are broached per hour on a Cincinnati hydraulic broaching machine. On the rear bearing cap, the broaching operation finishes the top and bottom bearing locks, clearance on sides and one end, two rectangular grooves, and the half-round bearing. On the other caps, they broach the bearing mating parting line, short bearing locks, half-round bore, and chamfer. Stock removal is 3/32 in. on each surface with a ram cutting speed of 28 ft. per min.

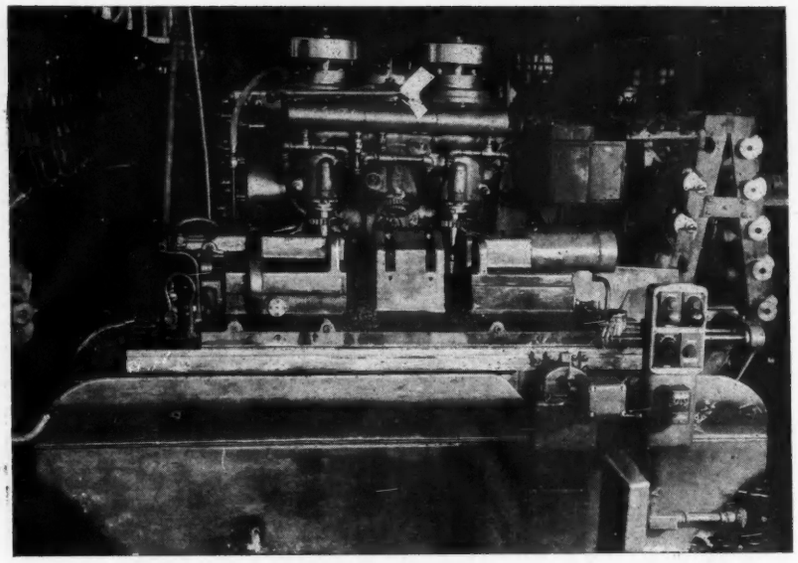
Many of the operations on the cylinder block are handled by Ingersoll equipment, as may be noted on the routing. The following paragraphs discuss briefly the features of some of the new Ingersolls that have been added to the line.

One of the special cycle Ingersoll drilling machines has been added for the operation of facing angular surface for valve seats and facing spring seats.

Retouch spraying operation in body shop.

This is a six-spindle machine in which the spindles engage a tool block mounted in the fixture with special cutters at the top and bottom ends. In operation, the spindles are up when the block is set into the fixture with the tool block fitting into the recess in the casting. The spindles then approach and engage the cutters. One set of cutters faces the valve seats; then the block is automatically indexed upward to engage the other set of cutters.

One of the most interesting of the new Ingersoll machines is the 5-spindle traveling table type milling machine that takes in one setting—the generator



Sundstrand built this unusual machine for cutting twenty-two (22) locating spots on crankshaft forging.

pad, distributor pad, pedal bracket boss, fuel pump pad, oil pump pad, oil relief boss. This machine, by a combination of cutter movements, takes the place of two separate milling machine set-ups used formerly. Its chief feature is a special retractable angular cutter which moves out of the way to clear projections on the block as the work feeds in, then approaches the surface to be milled, and automatically recedes. In operation, the cycle of the machine is —quick approach to the cutters, slow feed, quick return. All milling cutters have inserted J-Metal blades.

An entirely new machine on this line is the Ingersoll cam-and-crank boring machine, quite similar in operation to the machine that has been in use in the industry recently. It takes one block at a time and finishes the babbitt-lined cam bearings and the bearing holes for the crank bearings. The cycle comprises—loading and clamping, elevating block into cutting position, and feed. Rather close tolerances are speci-

Factory Routing Cylinde an

OPERATION	EQUIPMENT
Rough and finish mill top and bottom	Ingersoll 5-spindle drum type mill
Drill and ream (2) locating holes in bottom surface. Drill and counterbore (5) Welch plug holes in water side, drill for ¼ in. pipe tapped water drain hole in water side.	Ingersoll 8-spindle 2-way drill machine
Rough and finish mill ends and water pump pad	Ingersoll 6-spindle drum type milling machine
Core drill front and intermediate crank and cam bearings. Core drill and counterbore rear crank bearing. Drill and counterbore one Welch plug hole—one in each end. Counterbore rear cam bearing	Ingersoll 2-way 7-spindle crankcase boring machine
Mill bearing locks and valve side	No. 3 Ingersoll open side millers
Drill (2) long oil holes—2 blocks at a time	Ingersoll 8-spindle 2-way drill
Rough bore cylinders	Moline 2 station cylinder boring machine
Rough bore 12 valve throats	Moline adjustable spindle drill
Drill valve guide holes	12-spindle Ingersoll drill
Face angular surface for valve seats, and face spring seats	Ingersoll 6-spindle special drilling machine
Rough drill valve tappet holes	Moline drill
	Foote-Burt drill
Mill bushing locks in main bearing	Ingersoll milling machine
Mill ends 4 main bearings. Mill oil slinger groove in rear bearings	Ingersoll milling machine
Finish drill valve tappet holes	Moline 12-spindle drill
Drill (12) 3/16 in. angular oil holes for oiling valve tappets (4) ¼ in pipe tap main oil line holes 2 in each end (1) 7/16 drill 2¼ deep to ang. oil lead in bottom flange (1) 7/16 in drill, ¾ in. deep angular oil lead in pump pad to main oil line	Ingersoll 12-spindle drilling machine
Rough ream and float ream valve guide and valve tappet holes	Ingersoll 24-spindle reaming machine
Finish ream tappet holes and guide holes	Natco drill
Drill 32 holes in bottom	Natco vertical multi-spindle drilling machine
	Baker 32 spindle drill
Chamfer bearing cap bolt holes in bottom, oil relief hole and dist. hole	Natco drill press
Mill generator pad, dist. pad pedal bracket boss, fuel pump pad, oil pump pad, oil relief boss	Ingersoll 5-spindle traveling table type milling machine
Drill 6 holes for ⅜ in.—16 tap and 7 holes for 5/16—18 tap, valve side	Ingersoll 4-way 3-spindle drilling machine
One 17/64 in. hole	
One drill for ¾ in.—16 tap in oil relief hole, valve side	
Drill 24 holes for ½ in.—13 tap, in top	
Drill 15 holes for 5/16 in.—18 tap and 5 holes for ⅜ in. —16 tap, in front end	
Drill 8 holes for ⅜ in—16 tap and 2 holes for .375—.376 ream, rear end	
Finish bore valve throat and rough ream valve seat	Moline 16-spindle drill
Chamfer stud holes in top of black	Natco drill
Semi-finish bore cylinders	Moline cylinder boring machine
Chamfer top and bottom of cylinder bores operations on valve side	Ingersoll 17-spindle 3-way chamfering and drilling machine
Chamfer stud hole in valve covering opening, chamfer intake ports.	
Drill oil relief hole and chamfer, drill angular drain hole	

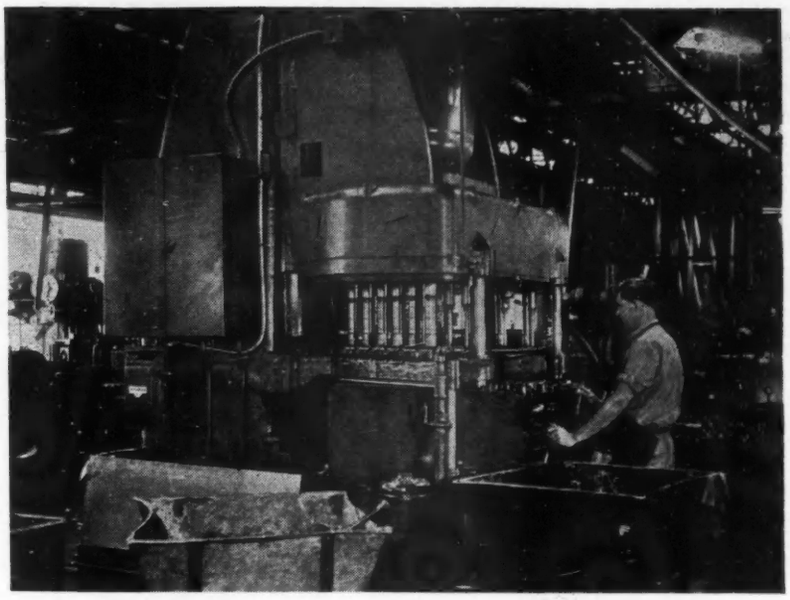
fied for this operation, as follows:

Alignment of crank bearings.....	0.0007 in.
Diameter held within	0.0005 in.
Alignment of cam bores.....	0.001 in.
Location end cam holes (vertical and horizontal)	0.002 in.

Toward the end of the block line will be found another new Ingersoll used for finish-facing bearing to length and chamfering outside of thrust bearing. Formerly this was a hand operation but with the new machine only the feed is done by hand. The table is motorized so that the block is clamped and elevated to the milling heads automatically. Then the operator feeds the two milling heads by means of a hand wheel with an indicator dial to check the operation.

Baker Bros. have provided a 32-spindle heavy-duty hydraulic feed machine for block drilling. This is a model 60-HO machine of the latest type.

Studebaker features double-honing of cylinder bores after boring operations

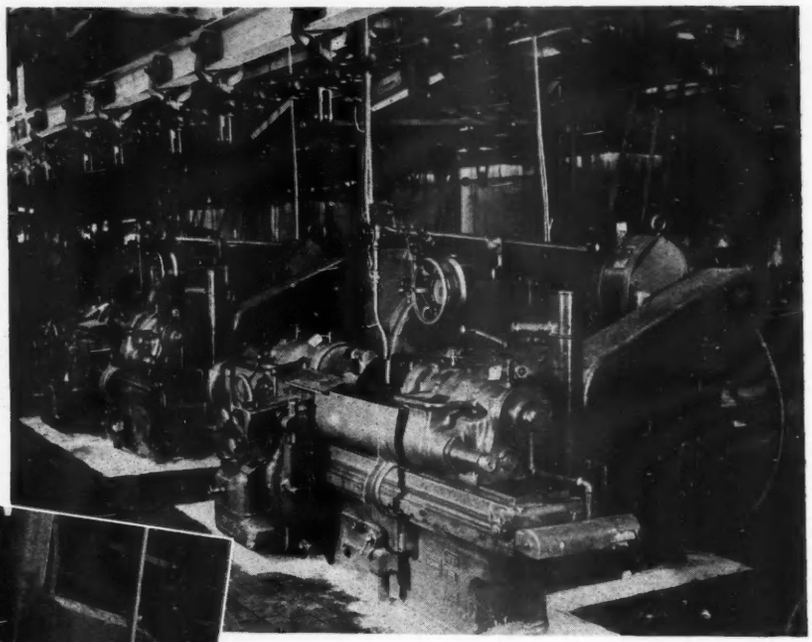


Huge three-station Greenlee of special design used for boring oval hole in connecting rod big end; and drilling and reaming wrist-pin holes. Each of the three stations holds six rods.

...and Bearing Cap Assembly

OPERATION	EQUIPMENT
at near camshaft bearing, core drill (1) 21/64 in. bore in breather hole	
Drill (4) oil holes from crank to cam bearings, core drill for one 1—½ in. oil filler hole	Ingersoll 2-way 6-spindle drilling machine
Drill 15 circulation holes in top	Ingersoll drilling machine
9 angular holes in valve side	Ingersoll 24-spindle 3-way drilling machine
Ream oil filler hole. Drill (1) 5/16 in. hole for by-pass	
Drill hole in distributor boss	Ingersoll 5-way 16-spindle drill
Drill 1—7/32 in. oil pump hole	Ingersoll 5-way 6-spindle drill
Rough ream and bottom oil relief hole—drill (12) 3/32 holes in tappet guides, drill 21/64 in. hole at No. 3 bearing	
Angular holes in water side (1) hole for ¼ in.—20 tap in dist. boss. Drill dist. hole, drill angular oil relief hole. Drill 3/16 in. holes in side of oil relief hole. Drill 5/16 in. oil circulating hole.	Ingersoll 2-head 5-spindle drilling machine
Rough ream dist. hole, flycut and chamfer oil pump hole, finish ream ⅝ in. diameter in oil relief hole	Ingersoll 3-way 3-spindle drilling machine
Ream distributor shaft hole, ream oil pump hole, drill 5/16 in. oil relief hole, tap upper end of angular oil lead	Ingersoll 5-way 3-spindle drill
Tap 8 angular holes, valve side	Ingersoll 14-spindle 3-way tapper
Tap 3 angular holes, water side	
Tap 2 horizontal holes, water sides	
Tap holes on top, both ends, and valve side, stamp dist. setting on boss	Ingersoll 4-way 66 spindle tapper
24 holes tapped in top	
20 holes tapped in front end	
8 holes in rear end	
14 holes tapped in manifold face	
Tap 32 holes in bottom	Fox tapping machine
Blow out stud holes	
Wash and blow out block	Washing machine
Inspect	
Assemble bearing caps with cap screws on conveyor	Bicycle tools
Semi-finish bore crank and cam bearing and ream two dowel holes in rear end of block	Ingersoll 2-spindle crankcase boring machine
Finish bore crank bearings, finish bore cam bearings, ream (2) dowel holes in rear end	Ingersoll 5-spindle crankcase boring machine
Chamfer front end of camshaft bearing and press (4) camshaft bushings into cylinder block	Special hydraulic horizontal press
Line ream crank and cam bearings and face cam bearing thrust face	Ingersoll finish bore crank and cam machine
Finish face crankshaft bearing to length, chamfer outside of thrust bearing	Ingersoll machine
Assemble all welch plugs	
Water test	Ingersoll water testing machine
Press in 12 valve stem guide bushings and drill one ⅜ in. oil gauge hole	Vertical hydraulic press
Seat valves	Special Leland-Gifford drill
Finish ream cylinder bores	Single spindle Baker drill (battery)
Rough lap cylinder bores	214 Barnes hydraulic lapping machine
Finish lap cylinder bores	Barnes hydraulic lapping machine with new Hutto hones
Inspect size, bores and stamp and push in washer	
Place in fixture and wash oil lines and ports	Special washing fixture
Blow off block	Booth

(Right) Finish-grinding crank pin bearings on battery of Landis hydraulic crank pin grinders.

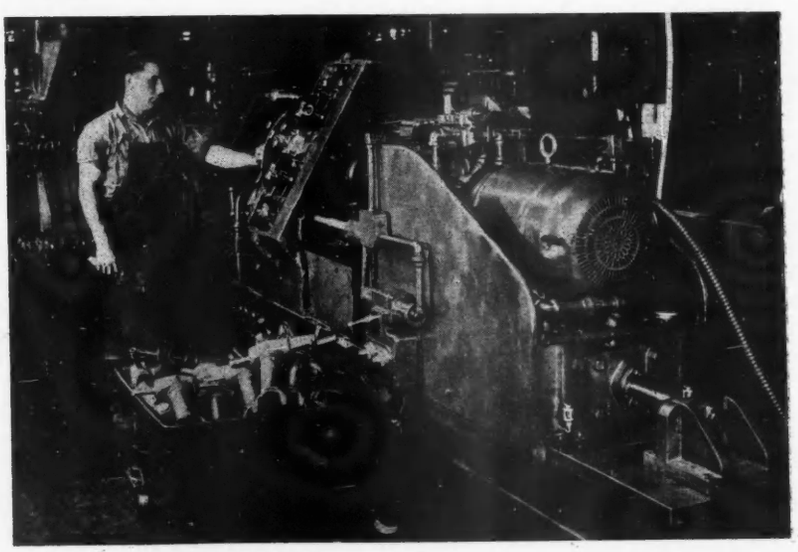


(Below) Another Cincinnati Hydro-broach set up for surface broaching bolt bosses and nut and bolt head faces on connecting rod forgings. This machine is entirely automatic in action save for loading and unloading.

effective pressure on the cylinder is accomplished by a variable pressure regulating valve. Variations in the fluid pressure produce a proportionate variation in the pressure of the abrasives upon the surface of the work. This is an effective means of compensating for variations in hardness of work material, discrepancies in the amount of stock to be removed, and deficiencies in the finish produced by the preceding operation.

The actuating cylinders are double

Two-way Snyder drilling machine drilling and reaming hole in steering knuckle support arm.

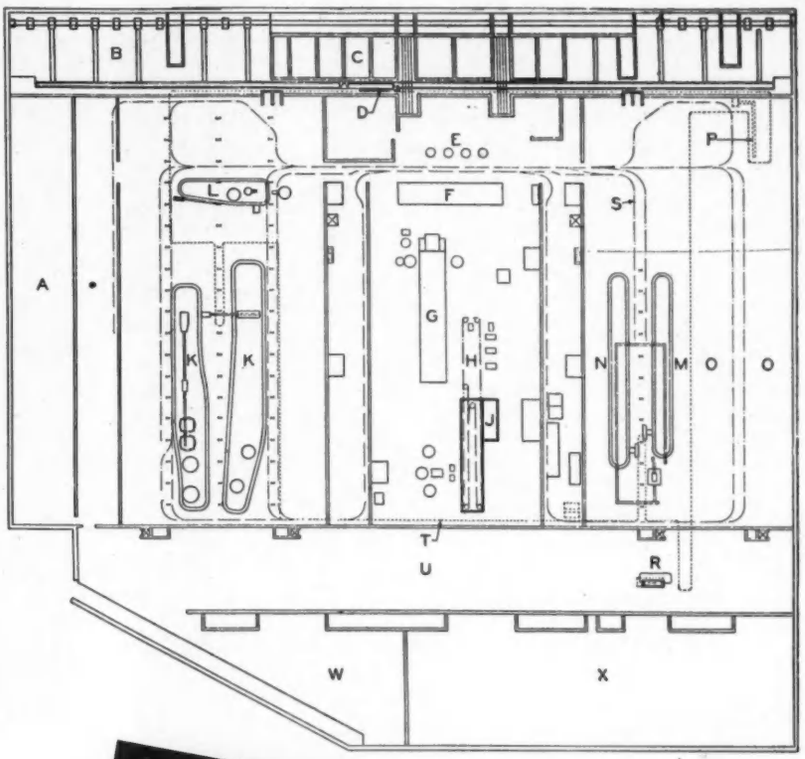


followed by reaming on a battery of single-spindle Baker drills. Rough honing is accomplished on a Barnes hydraulic machine fitted with micromatic hones. Finish-honing is done on a Barnes hydraulic machine fitted with a new head recently developed by the Hutto Machine Division of the Carborundum Co.

It consists of a hydraulic pump unit and pressure regulating valve, solenoid operated four-way valve with spring return, flexible conductor lines, actuating bracket and actuating cylinders, driving adaptors and hones. The pump furnishes the operating pressure for cylinder actuation. Regulation of the

Floor Plan of Studebaker Foundry

A Pattern Shop
B Metal Storage
C Sand Storage
D Sand Drier and Cooler
E Cupolas
F Old Oven
G Horizontal Oven
H Continuous Core Oven
J Heater
K Cylinder Block Units
L Manifold Unit
M Cylinder Head Mold Handling Unit
N Flywheel Mold Handling Unit
O Floor Molding
P Core Knockout
R Roto Blast Unit
S Five Ton Monorail System
T Overhead Castings Conveyor
U Cleaning Dept.
W Shipping Room
X Rough Machine Shop



acting; the downward stroke causing the hone to contract and the upward stroke to expand. The four-way solenoid operated valve is provided with a return spring so that when the solenoid is de-energized the operating fluid is delivered to the upper end of the cylinder, causing its piston to move downward and consequently contract the hones. The machine is equipped with electric cycle counter which provides automatic actuation of the solenoid valve upon completion of the work cycle. The honing tools are provided with positive expansion limit, therefore

Six-station Greenlee for piston pin bolt hole — drills, counterbores, spot-faces, and taps. Hydraulic feed, hand index for table. Each station holds three rods.

(Left) Special Ingersoll machine reams oil filler hole; drills oil lines from main supply to cam line.

over-running of the operating time will not cause oversize bores but merely results in decreased production if the operator is lax.

The tolerance on finish-honed bores is held to 0.00075 in. for roundness and straightness.

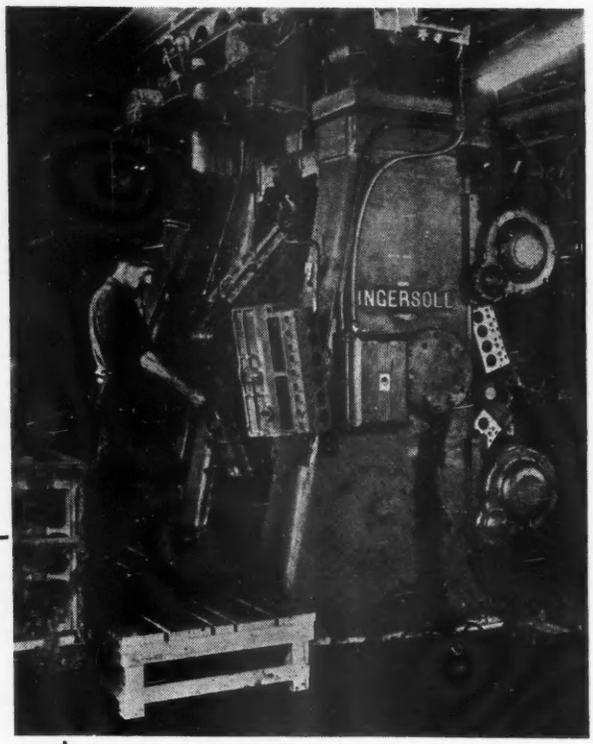
On the crankshaft line the company is bringing in many new items of equipment, including a battery of LeBlond lathes of several different types. The details of this installation will be found on the routing.

The first operation on the crankshaft line is that of milling 12 locating notches to handle the subsequent turning operations. This is done on a new Sundstrand milling machine featuring a multiplicity of milling cutters. This operation is complicated by the fact that a large number of locating spots are required to take care of a variability in fixtures occasioned by the use of different makes and types of machines on the same set-up.

This machine is a No. 25 Sundstrand hydraulic Rigidmil which has been provided with a special 4-spindle head. Two spindles are mounted vertically, one spindle at a 15-deg. angle and one spindle at a 30-deg. angle. All spindles except the spindle at 15 deg. are mounted in eccentric quills, providing eccentric adjustment. All four spindles have independent endwise adjustment. The head is mounted on ways crosswise to the machine table and is fed to depth hydraulically against a positive stop.

The hydraulic feed of the table can be varied from 1 in. to 40 in. per minute. A rate of 250 in. per minute is provided.

The operating cycle of the machine is as follows: With the spindle motors and hydraulic motors running, the operator loads shaft into the fixture. He then moves the fixture operating lever on the front of the machine and the part is positioned and clamped automatically. After the fixture is clamped, the head automatically starts in a cycle of rapid approach to work and feed to depth. When the head reaches positive stop the feed of the table is started automatically. The feed of the table is controlled by dogs through a cycle of:



Huge drum type Ingersoll mill is used for milling top and bottom faces of cylinder block.

Factory Routing Crankshaft Assembly

OPERATION	EQUIPMENT
Mill locating spots	Sundstrand mill
Rough and finish turn all bearings and gear fit, stradle face flange and shoulder, turn shoulder, straddle face main bearing cheeks, rough turn oil ring, rough turn thread diameter	Wickes "C.D." lathe LeBlond lathe 7A-CL
Straighten shaft	Straightening fixture
Finish turn all bearings	D.M. 4-station LeBlond lathe
Cut thread end to length and recenter	LeBlond lathe
Rough drill counterbore and recenter flange end	LeBlond lathe
Face cheeks on all pin bearings	No. 6 AC 2-spindle LeBlond lathe
Turn diameter and fillets on all pins	No. 6 AC 2-spindle LeBlond lathe
Straighten	Straightening fixture
Drill all oil holes	2-spindle Leland-Gifford machines
Mill oil grooves	Smalley general thread mill
Polish burrs from cheeks	Hammond polishing stand
Finish grind all pins	Landis hydraulic grinders
Straighten	Straightening press
Grind outside diameter and face of flange	Norton grinder
Grind outside diameter of oil grooves	Norton grinder
Rough and finish bore and ream pilot hole	Wolcott lathe LeBlond lathe
Mill one keyway	Garvin hand mill
Mill other keyway	Garvin hand mill
Drill and ream bolt holes in flange	Rockford drill
Burr edges of all pins and bearings	Speed lathe
Mill threads	Hanson Whitney thread mill
Straighten	Straightening fixture
Balance	Tinius Olsen balancing machine
Drill for balance—1 in. drill	Baker Bros. drill
Drill for balance ½ in. drill	2-spindle Leland-Gifford drill
Check for balance	Olsen checker
Wash before lapping	Washing machine
Lap all pins and bearings	Schraner lapper
Wash after lapping	Washing machine
Straighten	Straightening fixture
Inspect	
Assembly bushing and load conveyor	Arbor press

Feed left—rapid right—feed right—rapid left—feed left—stop. The table is then stationary in its starting position. When the table stops, the head is automatically and rapidly returned to its starting position. On the return stroke of the head, the fixture is automatically unclamped and the part is ready to be unloaded by the operator.

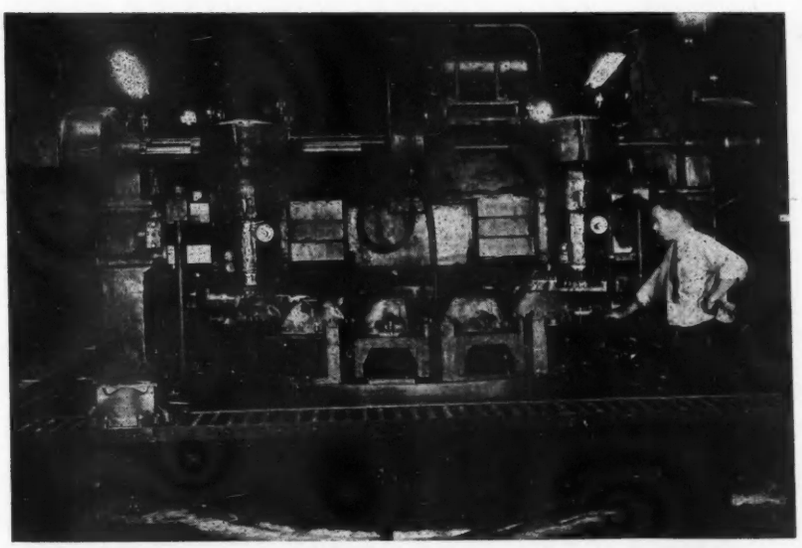
Greenlee Bros. & Co. have supplied five rather unusual machines. One of these is designed for drilling, reaming, spotfacing, and tapping piston pin bolt holes in the connecting rod. This is a hydraulic feed, vertical rear-column machine with a six-station hand indexing table holding three rods in each station. The operating cycle is as follows:

Station No. 1—Load 3 rods
Station No. 2—Drill for 25/64 in. dia.
Station No. 3—Drill for ⅜ in.—24 tap
Station No. 4—Comb. ¾ in. dia. spotface and counterbore
Station No. 5—Comb. ream for ⅜ in.—24 tap and 25/64 in ream
Station No. 6—Tap ⅜ in.—24

Then there is a battery of two Greenlee machines for drilling, countersinking and reaming connecting rod cap bolt holes. These are one-way, horizontal machines, with hydraulic feed and five station table with hand indexing. Each machine handles six pieces of work at a time—one is for rods, the other for caps. The operating cycle is as follows:

Station No. 1—Load 6 pieces
Station No. 2—Step drill, half through
Station No. 3—Step drill through
Station No. 4—Countersink
Station No. 5—Ream

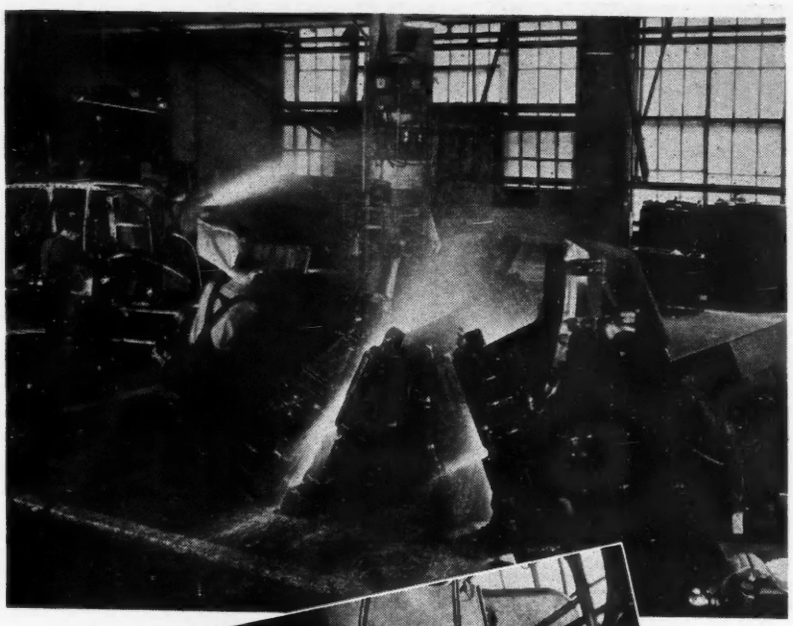
The fourth machine is used for elliptical boring of the connecting rod big end so as to produce an approximately round hole after sawing off the cap. This is a one-way, vertical rear-column machine, with hydraulic feed, and a



Tinius Olsen (Olsen-Lundgren) static and dynamic balancing machine checks crankshafts within 3/10 ounce-inch.

(Top) View in piston department—left is Morris balancing machine fitted with Toledo precision scale for automatic balancing within plus or minus one gram of standard weight. At the right is precision boring machine for piston pin hole.

(Left) Huge rotary Newton vertical milling machine rough- and finish-milling transmission face on clutch housing at rate of 80 per hour.



Big flash welder in body shop always good for pyrotechnic display.

three-station table with hand indexing. Each of the three stations holds six rods. Its operation is as follows:

Station No. 1—Load 6 connecting rods
Station No. 2—Elliptical bore through crank bearing cap end. Drill wrist pin hole
Station No. 3—Elliptical bore through crank bearing rod end. Rough ream wrist pin hole

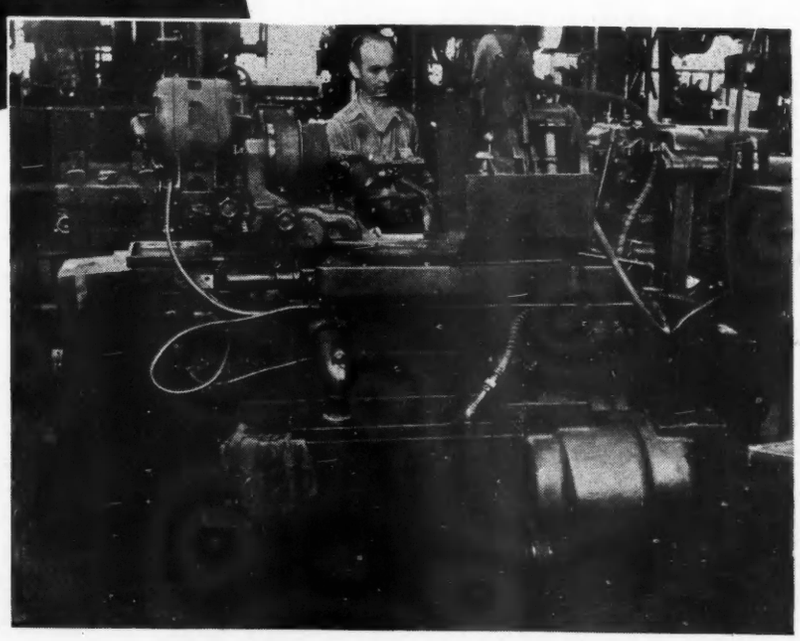
The fifth machine is a one-way, 30-in. rear-column, multiple drilling machine with hydraulic feed. It has a two-station, 52-in. diameter hand indexing table, and a 12-spindle head. Each station is provided with fixtures for four steering knuckle supports.

The following features are characteristic of the Greenlee machines described above:

All machines are arranged with hydraulic feed, using oil-gear pumps. The feed cycle is automatic and arranged with electrical control, so that the head feed can be engaged or reversed at any point in the cycle, which includes quick approach, variable drilling feed, variable dwell at the end of the stroke, and quick approach to the starting position.

All machines are arranged with a hand indexing turret, indexed from one position to the next by a 360-deg. movement of a lever placed conveniently for the operator. Positive location of the turret on the vertical machines is through leader bars carried on the

Close-up of new Baker streamlined drilling machine fitted with 32-spindle fixed center multiple drilling head for drilling oil pan rail holes and main bearing cap screw holes.



(Right) This Heald Sizematic internal grinder done yeoman duty for several years in finishing the con rod big end.

head engaging bushings in the fixtures on the turrets.

An interesting development on the cylinder block line is a special washing machine designed and built here and fitted in as a part of the conveyor. The block is clamped securely and then flushed throughout all its passages by a stream of water aided by air pressure. Studebaker has found that this device produces blocks absolutely free of all oil, dirt, and chips.

While not a new installation, there is a battery of two Michigan gear shavers that continue to give remarkable service. These machines are used to shave all timing gears—one being set up for metal gears; the other for Celeron gears. Shaving is used as a corrective treatment after gear cutting and since the introduction of this process Studebaker has had no problem whatever in producing quiet front end gear trains. In fact, we are told that the machines paid for themselves in a very short time due to elimination of rejects.

Foundry

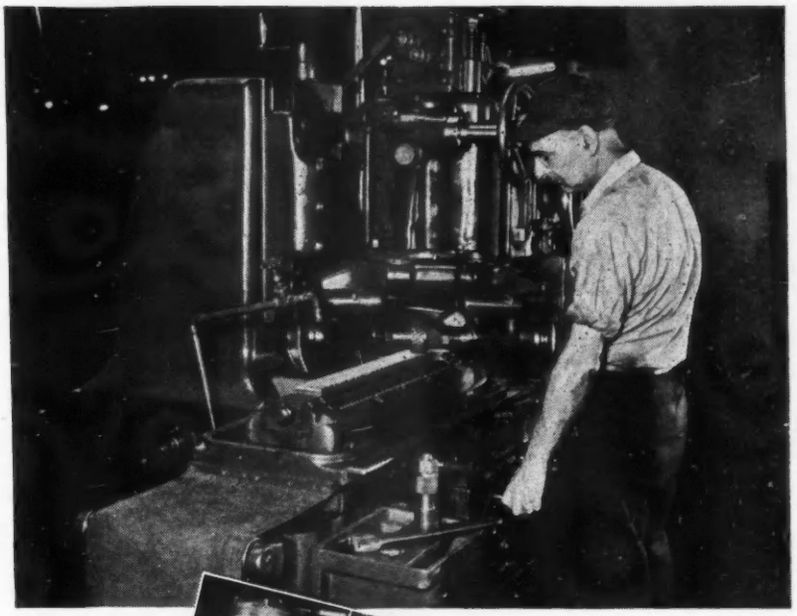
Studebaker's foundry boasts four big cupolas with a total capacity of 500 tons of hard and soft cast iron per shift. For 1938 production the foundry has been mechanized and improved by the introduction of the most modern equipment available. One of the major items is the installation of a 5-ton, 6-in. heavy duty monorail conveyor traversing the entire foundry. Another is the new core oven with its own conveyor system, installed by the Carl-Mayer Corp., Cleveland, Ohio.

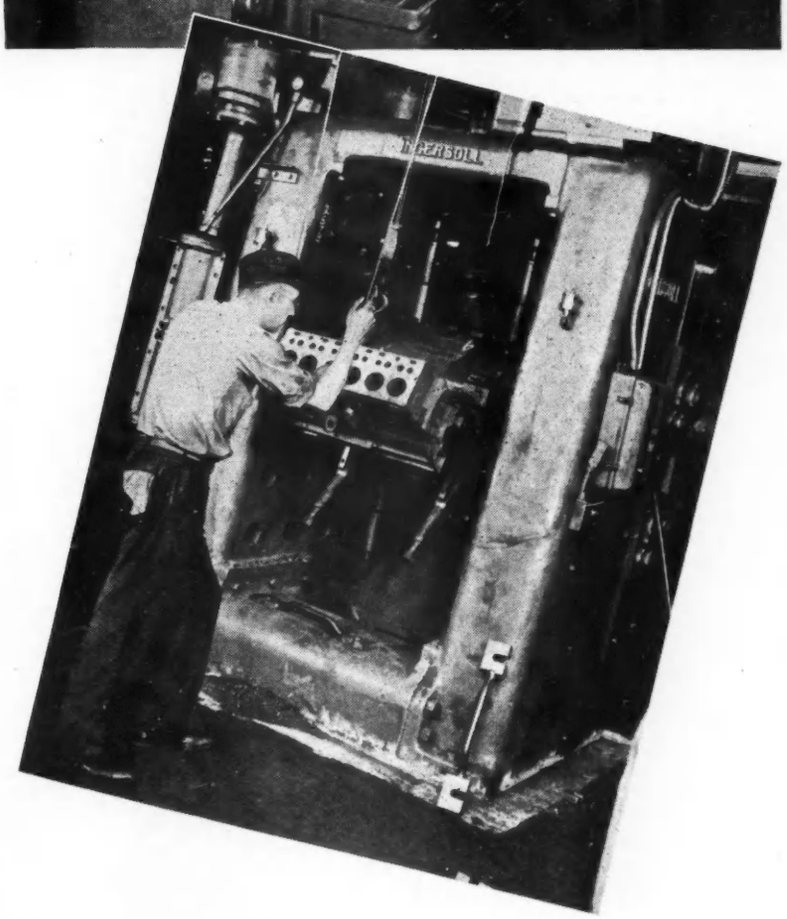
Worker comfort as well as complete freedom from occupational hazard are provided by the Pangborn Roto-Blast, shot-blast cleaning machine for cylinder block castings. This is the four-station machine that was brought out by Pangborn a little over a year ago. In addition, there is an American Wheelabrator for cleaning of all manner of small and medium-sized castings.

In discussing foundry modernization during the past few years, we have had occasion to comment on the increasing adoption of core blowing technique. It is of interest to note that Studebaker is probably one of the earliest users of the process in the automotive field. Not only do they blow small and intricate cores but they also use this method for making the cylinder cores.

Much of the foundry layout and equipment installation has been made by the C. O. Bartlett & Snow Co., Cleveland, Ohio, foundry specialists, who installed the first of the Studebaker continuous car-type, merry-go-round molding conveyors for the cylinder block line. This was subsequently supplemented by a Bartlett-Snow leak-proof apron conveyor to handle hot cores from the knock-out; another continuous conveyor unit for manifolds; and the cylinder block unit No. 2 which has a loop of approximately 456 ft.

Most recent of the big installations in the foundry is the Bartlett-Snow duplex car-type continuous mold conveyor consisting of two mold conveyors, placed side by side, for the flywheel and cylinder head divisions and served from the same sand plant. The loops, which are identical, have a circumference of 340 ft. Each is equipped with 75 cars





End faces of block are milled on this drum type Ingersoll.

(Top) Michigan tool gear shavers are used exclusively for shaving all timing gears—metal and Celeron. This finishing operation assures quiet timing gear trains.

with tops 20 in. wide and 4 ft. 6 in. in length. The construction of the cars with over-hanging aprons to keep sand and other foreign materials off the track, the construction of the wheels with anti-friction bearings, with flint hard chilled treads and labyrinth grease seals, etc., and the caterpillar drive insuring an even flow of power, is similar to the construction of the other mold conveyors. The flasks from these two mold conveyors are shaken out on Simplicity Vibrating Screen Shake-out equipment, one of which is provided for each unit. The sand plant consists of a large revolving screen, storage bins, Simpson mills, a belt feeder, a squirrel cage aerator and a belt-distributing conveyor that takes the sand back to the molder's hopper. A particular feature of this installation is the feeding of the two rows of molder's hoppers from the same conditioning unit and the installation in the basement of a strike-off sand conveyor which receives the strike-off sand through gratings and chutes from the several molding stations and takes it back into the system. Milwaukee jolt strip squeeze molding machines are used to make cylinder heads and flywheels on this unit.

One of the major objectives in the modernization of the foundry has been the improvement in sand conditioning procedure. Originally, it was considered sufficient only to dry core sand but on further analysis it has been found this also involves a cooling problem, if the sand is to be processed promptly. To accomplish the simultaneous drying and cooling of the sand, a 54 in. by 42 in. Bartlett-Snow rotary dryer-cooler was installed, alongside the core sand storage pits and under the existing dry sand hoppers. It uses oil fuel and the drying is accomplished by indirect-direct heat exchange. The cooler is an extension of the rotary dryer cylinder and operates on the counterflow principle.

The wet sand is of two grades—a sharp sand, containing about 4 per cent moisture—and a heavily bonded bank sand, containing up to a maximum of 8 per cent moisture. The sharp sand is dried at the rate of six tons per hour—the bank sand at three tons per hour. Either sand issues from the dryer-cooler at 5/10 of 1 per cent moisture, or less, and at a temperature not exceeding 120 deg. F., even during the hottest summer weather.

A diagrammatic layout of the foundry floor indicating locations of the Bartlett-Snow molding conveyor lines is reproduced elsewhere in the article.

Factory Routing Connecting Rod Assembly

OPERATION	EQUIPMENT
Coin to size	Hamilton coining press
Hand fit to gauge	Bench
Broach sides of bolt bosses, bolt seat and net seat	Cincinnati double ram hydraulic broach
Wash and Parkerize	Wash tank and Parkerizing equipment
Bore oblong hole drill and ream piston pin hole	Special Greenlee vertical drill
Chamfer both sides piston pin hole	14 in. mechanics drill
Wash and rinse	Wash tank
Prepare for babbitt and babbitt	Spinning machine
File tin and babbit off rod	Bench
Wire brush crank end	Hammond polishing stand
Bore crank pin oval	Coulter diamond bore
Saw off caps	Cincinnati hydraulic mill
Finish broach face on rod and cap	LaPointe double ram hydraulic broach
Drill and counterdrill oil holes and drill hole for saw slot	Kingsbury drill
Burr all holes	Bench and speed head
Drill, ream and chamfer bolt holes in rod	Greenlee special drill
Drill, ream and chamfer bolt holes in cap	Greenlee special drill
Counterbore caps	Natco drill
Mill bolt locks	Becker hand mill
Burr bolt holes in rod and cap	Speed head
Burr face of rod and cap and wash	Porter-Cable surface grinder Wash tank
Assemble rod and cap	Bench and HiCycle tools
Saw slot	36 in. Cincinnati mill
Finish ream piston pin hole	5-spindle Foote-Burt drill
Drill, ream, spotface and tap clamp bolt hole	Greenlee 6 station drill
Burr inside of slot and pin hole	No. 3 Garvin hand mill
Finish ream babbit	25 in Sibley drill
Hollow mill and chamfer both sides of rod	24 in. Sibley drill Barnes drill
Burr complete and wash	Bench, speed head and wash tank
Diamond bore	6-spindle Ex-Cell-O diamond boring machine
Finish spotface—1 side crank end	No. 121 Baker drill
Finish spotface other side of crank end	No. 121 Baker drill
Burnish both sides crank end	No. 314 Baker drill
Burr oil holes, wash and clean	Bench and wash tank
Inspect	

Body and Paint

As a part of the general picture, Studebaker has added two new Mahon ovens which are replacing obsolete equipment. They have also installed eight Mahon hydro filter spray booth units—four on the chassis assembly line and four in the body plant. This is but the beginning of a program in which all spray booths will be replaced by the hydro filter, washed-air units.

The two Mahon ovens have been installed in connection with the finishing of small parts such as fenders, hoods, splashers, etc. Work is carried through the ovens on monorail conveyor lines. Paint is applied on the priming operation through an automatic "Flo-co" unit in which the paint is flooded onto the metal parts, then passes over a dripping space and into the oven for baking. Baking temperature of prime oven is 275 to 300 deg. F. Baking time approximately one hour. Paint for the finish coat is applied in hydro filter spray booths through which the monorail conveyor carries the work. The overspray from these parts is collected by the hydro filter units so as to prevent the throwing of the pigments into the atmosphere. The pigments thus collected are skimmed from the sludge tanks at intervals. The spray booths

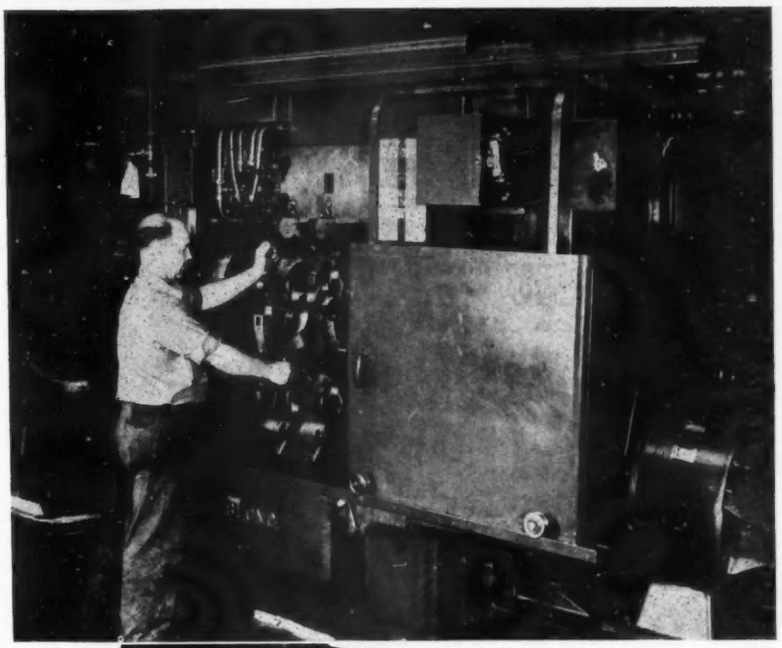
are in an air-conditioned room in which all of the air is filtered and heated before being blown into the room. The air supply equipment is placed in a penthouse above the roof of the building. It takes air into steam heating coils and automatic oil filters and distributes it through a perforated duct in the spray room.

The finish coat oven is approximately a duplicate of the prime oven with heating system capable of raising temperature to 300 deg. Fahr. Temperature of the ovens may be varied to suit various kinds of paints which may be used.

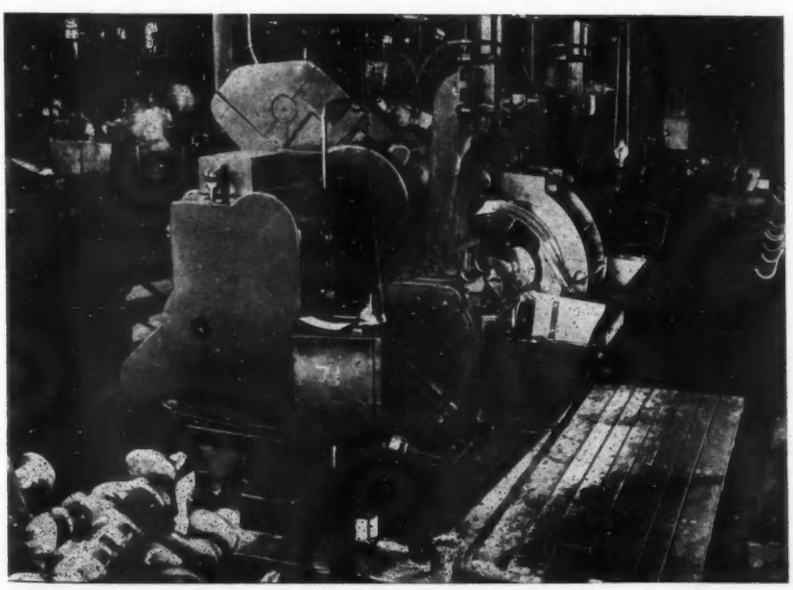
Four 40-ft. long, down-draft, hydro filter syrap booths have been istalled in the body shop. These booths are arranged to exhaust all of the air through the floor of the booth, the top being open so that the incoming air flows downward along the body past the operator and is exhausted at the operator's feet. The booths are wide enough so that doors can be opened for spraying door jambs.

Exhaust air from the spray booths passes through the floor of the booth into a plenum chamber where water sprays are used to knock down the pigments. The air is then exhausted to the outside of the building. The spray water and accumulated pigment drop into a sludge tank on the floor below where it is skimmed off at intervals. The water for these units is recirculated through a pump and cloth strainers. These spray booths are enclosed in a room constructed of sash and sheet metal walls and all of the air handled in the room is supplied by two large air supply units taking air from outside the building, drawing in through steam

(Turn to page 334, please)



Six-cylinder engine assembly station.



(Top) One of a battery of new crankshaft lathes installed at Studebaker. This is a new LeBlond cheeking lathe for finish-check con rod bearings, taking two shafts at a time.

Another of the new LeBlonds—rough turns and finish-cheeks all main bearings.

Just Among Ourselves

A Preferential Agreement for R.R.'s

NO large section of the general public or of our own industry, we presume, is familiar with the curious regulation of the War Department which provides that movements of National Guard Troops to field training camps shall be carried on by railroad only, when no Government owned motor vehicles are available and rail facilities are. Transportation of troops by commercial bus may be authorized only "where rail transportation is unavailable and the proper official of the concerned railroad association makes a written statement to that effect."

Such a regulation* removes from commercial bus lines a large section of potential annual contract business and throws it to the (also commercial) rail lines. Back of this apparent discrimination is the fact that a great many railroads, at their inception, received Federal grants of land and privilege. In return for this, and as a matter of national policy, the War Department has effected with the railroads a Joint Military Passenger Agreement, copies of which are not available for public inspection. The agreement, it is understood, makes rate concession for troop movements as a partial compensation for the use of public lands by the railroads.

Other provisions of the agreement, no doubt, refer to the use of the railroads by military authorities in time of emergency, and are properly reserved from public consumption. But provisions which result in keeping bus operators from enjoyling a fair share of the peace time business of troop movements seem to us to be an unwarranted survival. In time of emergency there is every prospect that bus operators would be "mobilized" at Government-determined rates, but without benefit of a considered peace-time agreement such as the railroads enjoy.

As ably demonstrated by Riley Elgen in these columns,** motor-vehicle operators of all classes pay through the nose for the use of the public highways. Bus operators should, we believe, have a crack at some of the Army's peace-time business in the interest of common fairness, of free competition (if the concept is not dead entirely), and in the interest of efficient performance in time of national emergency.

* See Circular No. 23, Field Training Camps, Office of the Chief of the National Guard Bureau, War Department.

** See AUTOMOTIVE INDUSTRIES, July 10, 1937, p. 50 *et seq.* "It's the Motorist Who Pays the Bill," by Riley E. Elgen.

Mexican Government Flirts With Car Making

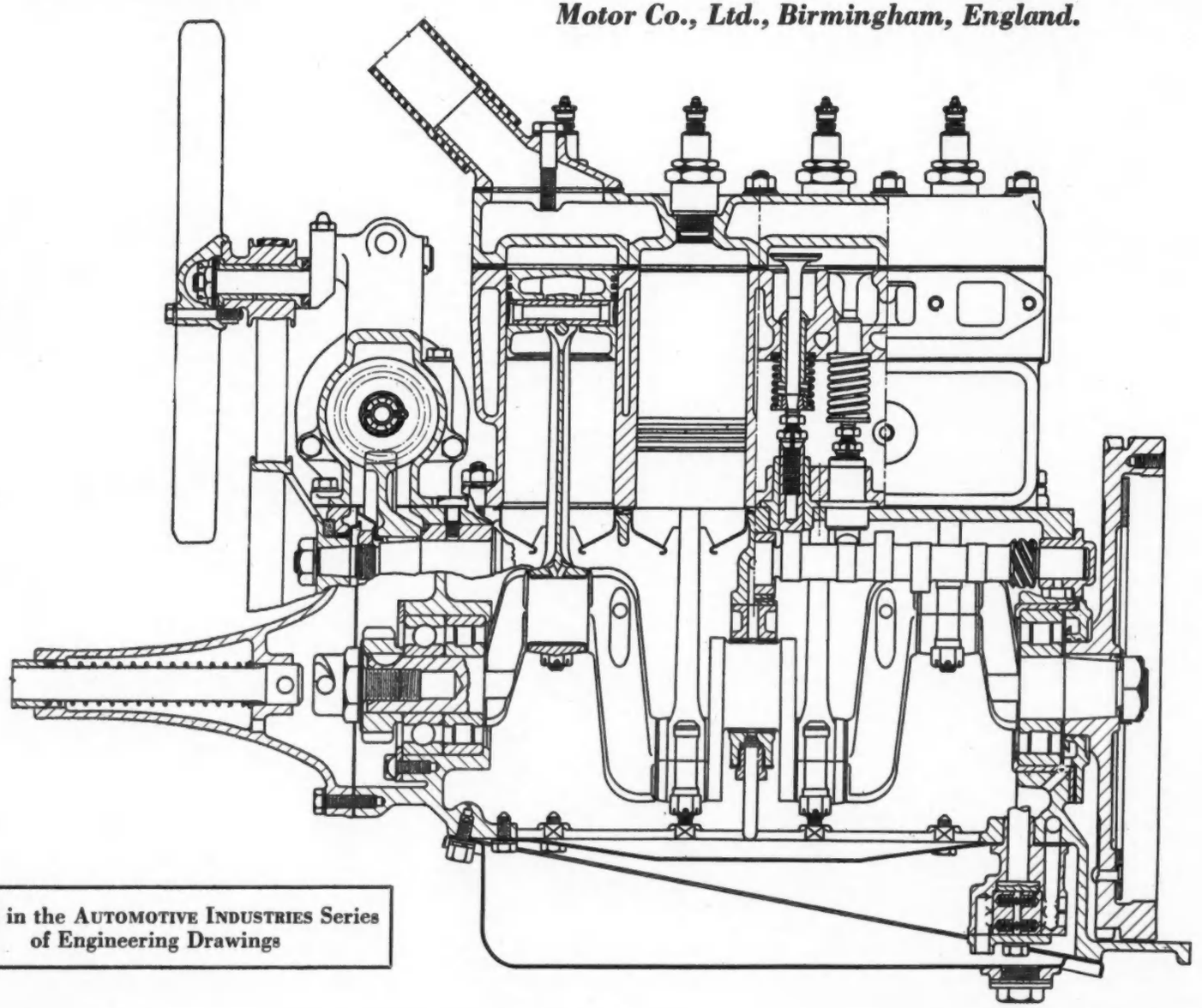
THE Mexican government is flirting with the idea of building and operating an automobile manufacturing plant, according to some roundabout information which reached the office the other day. Our informant indicates that the project is being thought around the idea of a plant which would have a capacity of about 150 cars and 50 trucks per day. Credibility is lent to the rumor by the Mexican government's several other experiments in government ownership, and by its current interest in road building and highway safety. The Government of Mexico is alive to automotive possibilities. Taxing a people with the economic divergences of the Mexican is a touchy and difficult business. If the government could provide itself with additional sources of revenue obtained through voluntary purchase of goods whose circulation (in Mexico) would be limited to the relatively wealthy, it would probably appeal to the Socialist experimenters below the Rio Grande.

How About More About Racing Cars?

DURING the past year we have been delighted by the number of people who have taken the trouble to write in with constructive suggestions about this magazine. We recall this so we will feel better about the fact that a half dozen recent correspondents have taken us apart for not printing more information about racing cars and their design. If were as sure, as our correspondents seem to be, about widespread interest in the subject among automotive engineers, we'd probably print more.

The record shows, incidentally, that during the past year, we *have* printed more pages devoted to racing car design than any other American publication not devoted exclusively to racing. But, if you'd like more, we'll listen. How about it?—H. H.

AUSTIN . . . . *Seven hp. passenger car engine manufactured by the Austin Motor Co., Ltd., Birmingham, England.*



No. 44 in the AUTOMOTIVE INDUSTRIES Series of Engineering Drawings

AUSTIN . . . .

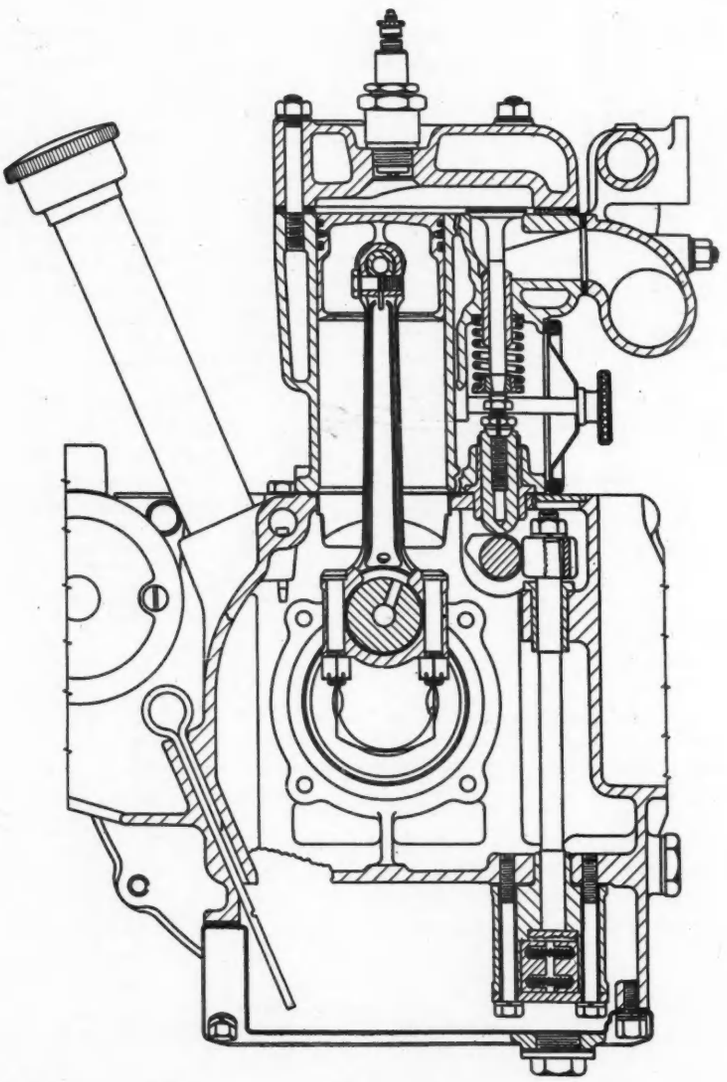
This engine was recently redesigned and now has three bearings for both crankshaft and camshaft. Center crankshaft bearing is 1¾ in. in diameter; diameter dimensions of front and rear journals are 1⅛ in. and 1¼ in., respectively. Crankpins are 1¼ in. in diameter by 1¼ in. wide.

Bore and stroke remain unchanged and are 2.2 in. by 3 in., making total piston displacement of the 4-cylinder engine 45.6 cu. in. Horsepower rating is 17 b.hp. at 3800 r.p.m.; compression ratio 6 to 1.

Cylinder head and block are cast iron and a pressed steel sump is attached to the aluminum crankcase. The aluminum pistons carry three rings, two compression and one oil scraper. Oil deflecting plates made of steel are used at the bottom of the cylinders. Connecting rods are also steel with steel-backed liners.

An eccentric vane pump delivers oil under pressure to the central main bearing and to four discharge points in the crankcase from which oil is directed to the connecting rod big ends.

Other elements of the Austin engine include: mechanical pump fuel feed; centrifugal automatic ignition control; thermo-syphon circulation; six-volt generator.



TOOLS OF TOMORROW

(Continued from page 303)

12 in. by 3 in. for face grinding and will swing work 14 15/16 in. over the table top. A 5 hp. motor is required for the wheel drive and a ½ hp. motor for the work drive.

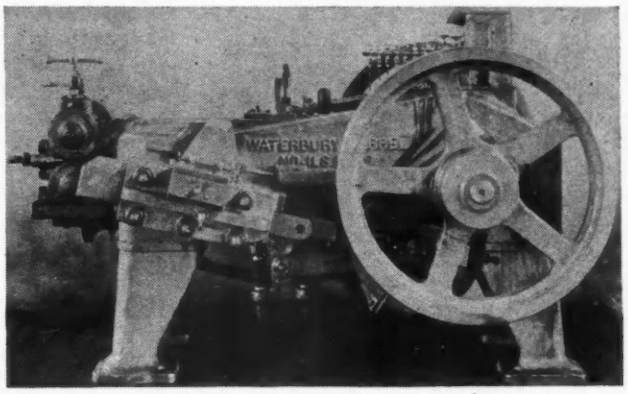
Crank Header

. . . solid die, double-stroke machine for cold heading high carbon alloy steels at high speeds.

The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., recently redesigned its standard line of solid die, double-stroke crank headers to meet demands for cold heading high carbon alloy steels at high speeds. The changes include use of an entirely new frame of large cross-sectional area and a cut-off mechanism of improved construction.

The cutoff bar is large in diameter and operates through the frame at right angles to the wire, the inner end being supported so that the knife is held flush with the face of the die. The hinged fiddle-bow, formerly used to hold the blank in the cut-off knife, has been replaced by a spring finger fastened to the knife.

There are seven standard sizes ranging from the ¼-in. machine rated at 100 to 125 blanks per min., to the 1½-in. machine rated at 35 per min.



Waterbury crank header for cold heading high carbon alloy steels at high speeds

Pipe Cutter

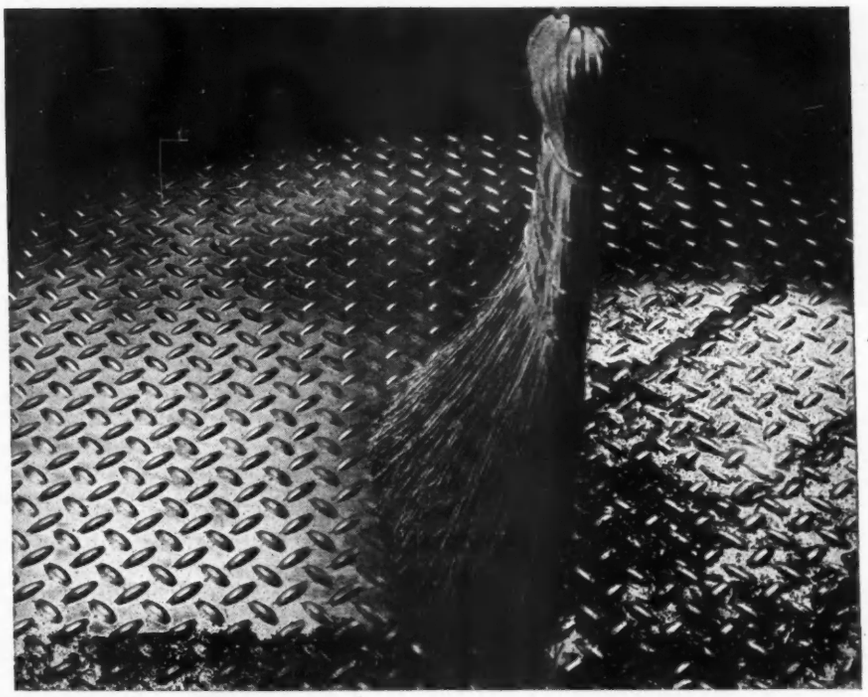
. . . Rollers of Semi-Automatic Machine Operated by Cam Action.

The Geist Mfg. Co., whose product is sold through the Landis Machine Co., Waynesboro, Pa., recently placed on the market a semi-automatic roller pipe cutter with a number of new design features which include operation of the rollers by cam action.

Movement of the rollers in a vertical plane is actuated by a gear driven disc cam. Separate cams are necessary for standard and extra heavy pipe.

Operating cycle of the machine is controlled through pick-off gears. The gear train is arranged so that by reversing one pair of gears, or employing an extra pair furnished as standard equipment, four different speeds are available. Speeds are fixed so that it is possible to cut off from 10 to 35 nipples per min., depending upon the pipe diameter.

The new Geist is equipped throughout with anti-friction bearings, a heavy-duty roller bearing being used on the cutter disc spindle to assume



Make Factory Floors Safe with INLAND 4-WAY Floor Plate

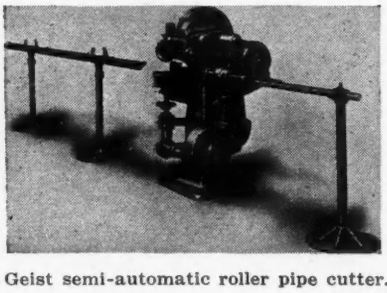
No dirt catching pockets or corners— clean, safe, strong, economical

● Inland 4-Way floor plate with projections centering one another at right angles gives four way traction for feet and wheels. The angular edged projections give increased traction and safety. There are no corners or pockets to trap dirt or liquid making it easy to keep clean. The overlapping projections reinforce one another giving extra stiffness and strength. They also match when laid side to side or end to side reducing installation costs.

Check up on the many other advantages of Inland 4-Way floor plate. Write for new catalog which gives complete information.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City

RYERSON



Geist semi-automatic roller pipe cutter.

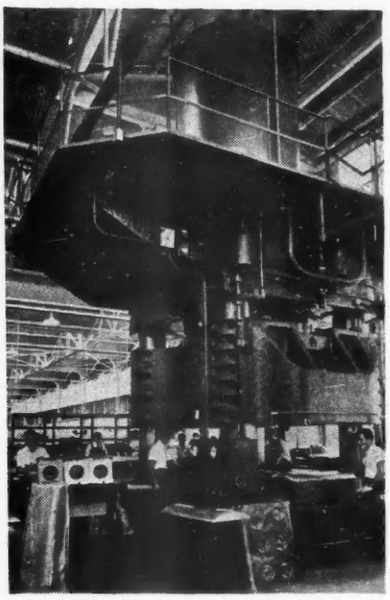
the thrust load of a heavy cut. The lubricator built into the machine for lubricating and cleaning the cutter disc is adjustable for any diameter of disc and consists of a reservoir that holds about one pint of oil. A needle valve controls the flow of oil, permitting just enough lubricant to flow into two felt pads which are in constant contact with the cutter disc under spring tension.

A pipe support is supplied in the form of a trough which eliminates gripping of the pipe while under cut. The trough is 10 ft. long and is lined with a series of metal strips so placed as to minimize any friction between the pipe and the trough.

Huge Press

. . . with pressure capacity of 5000 tons installed in Douglas Aircraft plant.

What is said to be the largest high-speed hydraulic press in the world was recently installed in the plant of the Douglas Aircraft Co., Inc., Santa Monica., Calif. Built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, the press was sold to the aircraft company by Herberts Machinery Co., Los Angeles. The big machine has a pressure capacity of 5000 tons and is operated by the H-P-M hydro-power Fastraverse system which makes it a self-contained press. Several thousand production operations in shaping and forming parts for Douglas commercial transports are accomplished on this unit.



Douglas Aircraft recently installed this huge press in its Santa Monica plant.

The press weighs 840,000 lb.; maximum opening between platen and bed is approximately four feet. Total pressing force is created by a single hydraulic ram 6 ft. in diameter which is actuated by oil under a pressure of 2500 lb. per sq. in.

Drawing Press

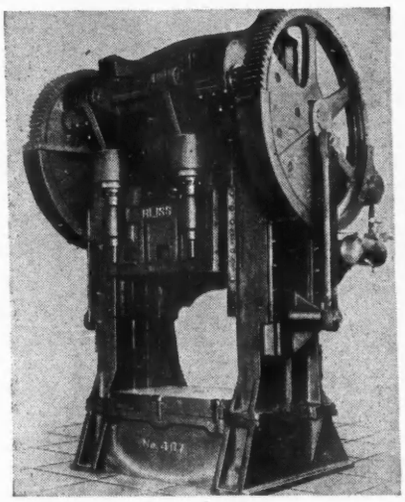
. . . toggle, double-action machine draws shell 10 in. in depth.

The double-crank, double-action, straight-sided, toggle drawing press made by E. W. Bliss Co., Toledo, Ohio, and illustrated herewith, is a long stroke model. Its frame is made of four separate castings held together by heavy steel tie-rods which are shrunk in. Among the advantages of the machine emphasized by the maker are in-

ABLE TO TAKE THE WORST
A TOUGH CONTINENT
CAN GIVE
TO the few remaining automotive engineers who have not yet adopted Aetna "T" Type Clutch Release Bearings there must be some significance —some persuasion—in the fact that these sensational bearings have mastered every conceivable test that time and a continental proving ground can impose. In millions of passenger cars, trucks, buses, and tractors operating in frigid to torrid temperatures, in dust, over mountains, and under the constant "stop and go" driving conditions of city traffic, their performance has proven them indisputably the greatest clutch release bearing ever produced. Such a record of all-around dependability plus Aetna's "T" feature that maintains perfect and permanent lubrication, eliminates the necessity of machining operations for oil fittings, and ends the punishing wear of eccentric thrust, seems more than adequate to justify your consideration. Why not send for a sample and "give it the works?" We'll rest our case on the results.
AETNA BALL BEARING MANUFACTURING CO.
4608 Schubert Ave., Chicago
Detroit Office: 7310 Woodward Ave.

cluded positive gripping for stretching jobs with draw beads and power economy on deep draws. It is possible to convert the equipment from a double-action into a triple-action press by addition of Marquette drawing cushions in the bed.

Control is completely electric, with push buttons to start, stop, or inch the



Bliss double-crank action, toggle drawing press

press. The clutch is a new Bliss full automatic, air-operated, combined friction clutch and brake with clutch mounted in the flywheel. A 35 hp. electric motor drives the flywheel through vee-belts, which in turn drive the double geared twin-drive train of gears.

Some of the more important dimensions are as follows: diameter of crankshaft at bearings, 7 in.; at pins, 8 in.; plunger stroke, 21 in.; blank-holder stroke, 14 in.; shut height bed to blank-holder, stroke down adjustment up, 34 in.; bolster, 6 in. thick.

Crankshaft and intermediate shaft have renewable bronze bushings while the driveshaft is mounted on renewable Timken roller bearings. The bed is arranged to allow addition of air cushions.

Thread Grinding

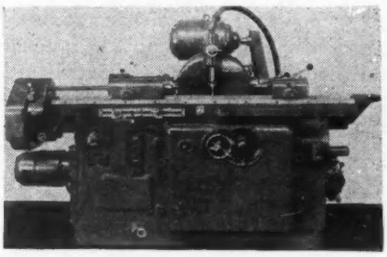
machine designed to make threads in hard or soft material on work up to 8-in. diameter when using 20-in. wheel.

An automatic thread grinding machine designed to grind threads in hard or soft material on work up to 8-in. diameter when using a 20-in. grinding wheel has been brought out by the Jones & Lamson Machine Co., Springfield, Vt.

Work 48 in. long may be held between centers and 18 in. of thread may be ground anywhere on 36 in. of work length. Work 11½-in. diameter may be swung over the work slide and 11½-in. diameter threads may be ground when the wheel is 16½-in. diameter, or smaller. A 20-in. diameter grinding wheel is furnished as standard.

Helix angle capacity of the new machine has been increased to include 25 deg. right hand and 30 deg. left hand. The helix angle is adjusted or changed by means of a worm and gear.

Standard equipment includes change gears for pitches from 2 to 48 inclusive. The machine will grind single, double, triple, quadruple, and sextuple threads, either right or left hand. Using a simple hardened and ground former, it will grind taper, combination of straight and taper, or double taper threads.



Jones & Lamson automatic thread grinding machine.

CONSISTENT
Performance
UNDER VARYING ROAD, LOAD AND WEATHER CONDITIONS
BECAUSE...
The disc areas exposed to the jacket water are so arranged that the hydrostatic forces on the valve discs neutralize themselves.
An external balancing disc, which neutralizes the hydro-dynamic forces, holds operating temperatures the same as still water set temperatures.
A special machine operation makes the valve seat tight and keeps bleed under definite control.
The unique Dole universal motion joint for connecting the thermostat element cannot stick, bind, or cause friction.
DOLE
Thermostats
THE DOLE VALVE COMPANY
1801-1941 Carroll Ave., Chicago
OTHER DOLE PRODUCTS
Dole Thermostatic Bi-Metal for uniform and dependable operation of manifold heating controls, automatic choke controls, generator cut-out controls, etc. Dole Draft Deflectors for closed car ventilation. Dole Fittings for tubing connections.

The new machine, with necessary attachments, will grind button type hobs and circular chasers without lead; it will back off, or relieve, straight or taper hobs or taps with either straight or spiral flutes. A standard attachment may also be furnished for grinding interrupted threads on straight- or spiral-fluted taps.

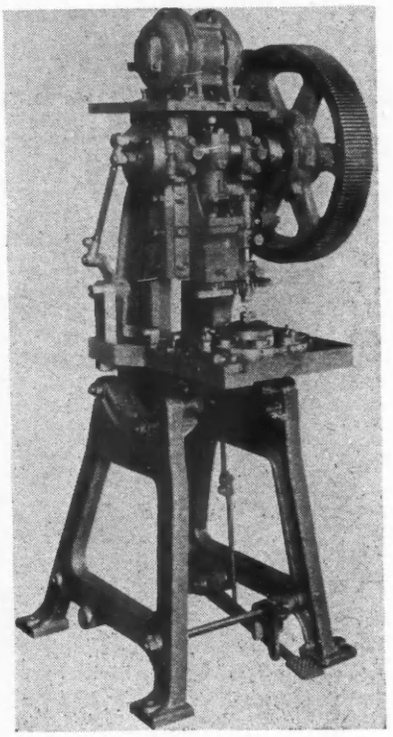
Running all types of grinding wheels at efficient work speeds is accomplished by a scale attached to the trueing device for recording wheel diameter at all times and a graduated rheostat with pointer indicating spindle revolutions. A chart on the wheel slide shows the number of surface feet the wheel is running, based on the wheel diameter and spindle revolutions. As the wheel is reduced in diameter, the proper speed is maintained by simply turning the dial on the rheostat.

Etching Steel Parts

. . . eight-station dial feed facilitates marking trade-mark and number with small press.

A Toledo No. ¾ press was recently adapted by the Toledo Machine & Tool Co., Toledo, Ohio, division of E. W. Bliss Co., to a special piece of work requiring an eight-station dial feed for acid etching the trade-mark and number on hardened steel parts.

A rubber stamp die is attached to the slide and rotated 180 deg. every stroke of the press. The back stamp die comes down to touch a pad of acid then, on the next stroke, rotates 180 deg. to the front and applies the etching solution to the work which has been placed under the die by a dial feed. Coincident with movement to the front of the acid-wet die, the die that was in front rotates 180 deg. to the rear to pick up more acid for the next impression. Thus, a piece is etched for every stroke of the press. Pieces continue around in the dial after being stamped and are dropped through a hole in the bolster into a container.



Toledo press with eight-station dial feed for acid etching trade-mark and number on hardened steel parts

The Toledo No. ¾ is an open back inclinable press with 1½-in. stroke, 6-in. shut height on the bed and 1-in. bolster. A ½ hp., 900 r.p.m. motor is geared directly to the flywheel.

Joseph B. Eck

Joseph B. Eck, 50, president of the Globe Co., Sheboygan, Wis., steel stampings, and one of the outstanding experts on internal combustion engine design and production in the United States, died recently of a heart attack. He was a native of Germany, received his engineering education in England, and from 1912 to 1926 was general manager of the old Falls Motor Corp., Sheboygan Falls, Wis., and from 1928 to 1931 vice-president and general manager of the Universal Motor Co., Oshkosh, Wis., specializing in marine engines.

young

HEAVY DUTY RADIATORS

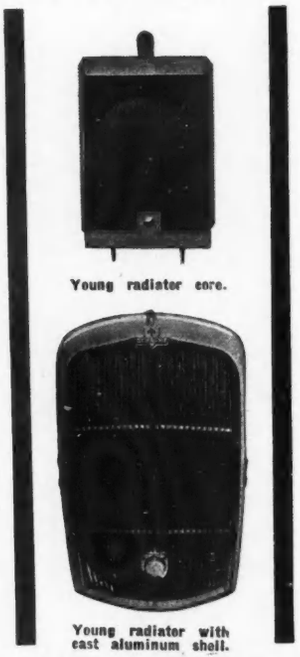
FOR

GASOLINE — DIESEL ENGINES ON MODERN TRUCKS AND COACHES

Keeping pace with the modern trend Young has developed new ideas in the radiator line to fit the newest designs in coaches and trucks and to meet the ever increasing demand for more cooling capacity in the same or smaller space. Whether the radiator is to be a new streamlined design or is to be used in conjunction with an installation with the power plant mounted in the rear, Young engineers can offer a unit to meet your requirements.

YOUNG RADIATOR COMPANY

RACINE WISCONSIN



Young radiator core.

Young radiator with cast aluminum shell.

Model 30-R 31 passenger Twin Coach suburban bus with rear engine cooled by Young radiators.

YOUNG RADIATOR COMPANY
RACINE, WISCONSIN

Young Quality

Automotive Abstracts

(Continued from page 304)

Pure asphaltic bonding materials soften at high temperatures, for which reason it was found desirable to add various natural gums and oils to the asphalt base to increase the rigidity of the product. Fabrics so bonded have comparatively stable friction characteristics over a wide range of temperature, the friction coefficient remaining between 0.3 and 0.4 up to 500 deg. F. Above this temperature the bonding medium is gradually driven off and the friction coefficient has a tendency to rise. In this temperature range the friction characteristics are more nearly like those of asbestos-base than like those of bonded fabric. The proportion of bonding material introduced has a marked influence on the stability of the friction characteristics. If the quantity is excessive it may exclude and produce a considerably augmented grip of the friction surface. A similar effect is produced when these friction linings are used for the first time, which is due to the presence of a certain amount of the bonding material on the surface of the lining. In some cases the friction coefficient is raised temporarily to 0.6 or 0.7 and this may give rise to fierceness or chattering. This trouble, which is always of short duration, may be considerably reduced by grinding 0.015 in. off the rubbing face after the lining has been riveted to the shoe.

Mixtures of various vegetable gums are used to a small extent and offer several advantages. Their coefficients of friction are reasonably stable over the same temperature range as the asphalts, but tend to be slightly higher, generally 0.35 to 0.45, while the bonding compound may be naturally non-exuding. The cementing properties of the bonding media and the wearing qualities which they impart are generally slightly better than those of the asphaltic compounds.

Rubber, which has been widely used in the U. S. as a bonding material for several years, finds little favor in Europe so far. In the earlier types a sheet of rubber-proofed asbestos cloth was folded to form a number of plies of the desired width, which were then stitched together and finally vulcanized. All of the later examples are of the molded type and the use of various "fillers" gives a certain degree of control of the friction values. Either rolls of flexible material or rigid segments may be produced, depending on details of the vulcanizing process employed. The former wears well under normal conditions but rapidly disintegrates under severe conditions. The latter is far more resistant to punishment but is the most destructive of all the more common friction materials on the metal drums. All forms of rubber-bonded materials compare poorly with most other types in respect to performance when wet.

Synthetic-resin bonded media, owing to their high mechanical strength, permit of wide variations in the structure of the asbestos base. Three types are in general use, viz., the molded lining in which the basic asbestos is used in the unspun fibrous state; the laminated type in which sheets of asbestos cloth are built up to the necessary thickness and held together by the bonding compound, and the solid woven type. The molded type, generally made from resin-impregnated asbestos millboard, are widely used. The uniform distribution of some solid lubricant, such as graphite, results in a low friction coefficient. While they are inclined to be rather brittle, this can be overcome by the use of longer asbestos fiber, at some increase in cost. Wiremesh backing is also employed.

Earlier synthetic-resin-bonded materials, which were alcohol-soluble, had certain definite traits distinguishing them from the asphalt- and the vegetable-gum-bonded materials. Up to a certain temperature their friction coefficients tend to be appreciably higher. At the temperature referred to a pronounced drop in the friction coefficient occurs, but the original value is restored as the temperature drops. Most specimens have a normal friction coefficient of 0.4 to 0.5 up to about 450 deg. F., above which temperature the coefficient falls gradually to about 0.2. While this may limit the use of such friction material, there are considerable applications where they are practically ideal. Their rigidity and immunity from any softening action render them especially suited for work under heavy pressure in oil. Recent developments in this type of friction material have almost entirely eliminated this deficiency, although they have somewhat reduced the normal friction coefficient, to between 0.35 and 0.38.

The later, oil-soluble resins, allied with members of the asphalt and vegetable-gum groups, virtually eliminate this fade-out characteristic, at some sacrifice with respect to friction coefficient and rigidity. Modern friction fabrics of the oil-soluble-resin type have the heat-resisting characteristics of the earlier asphalt-bonded linings and combine with them higher friction coefficients, greater rigidity, and almost complete freedom from exudation.

Cementation properties of the synthetic resins are excellent, as a rule, and are reflected by the better wearing properties of the materials as compared with asphalt and vegetable-gum compounds. There is a marked tendency to revert to metallic reinforcing materials, the softer metals, usually lead or zinc, being used, and woven with the fabric. Zinc is preferable, since it can be drawn to a finer gage and spun with the asbestos. The effect of these soft metals is to inhibit scoring of the metal mating faces and to enhance the wearing qualities of the product to a considerable degree.—E. W. Sisman in *A.I.E. Journal*.

(Turn to next page, please)

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Effect of Phase Errors on Indicator Diagrams

When taking indicator diagrams it is very important that the drum on which the card is mounted be accurately in phase with the crankshaft of the engine, as otherwise the i.m.e.p. determined from the diagram will show a large error. It can easily be seen that if the indicator drum lags behind the crankshaft, the expansion line of the diagram produced will be too high, so that the i.m.e.p. obtained is too large, or, in other words, there is a positive error, whereas if the drum leads the crankshaft there is a negative error. Pye in his book on Internal Combustion Engines states that an error of 1 deg. in the phase angle results in an error of 5 per cent in the i.m.e.p. A German writer has now made a graphical determination of the effect of phase-angle errors on the i.m.e.p. He started out with a published diagram taken from a B.M.W.-IV aircraft engine and redrew it for errors in the phase angle of $\mp$ 1, 2, 5 and 10 deg., with the aid of a piston-motion table. The diagrams were drawn to a large scale and then planimetered. It was found that a graph of the error in per cent, on a base of phase error in degrees, is a straight line, and a phase error of 3 deg. in either direction gives an error in the i.m.e.p. of approximately 10 per cent. For a phase error of 10 deg. the i.m.e.p. error is 31.6 per cent The statement of Pye is thus verified and the conclusion is drawn that if it is desired to determine the i.m.e.p. accurately it is best to measure the brake and friction horse powers separately and obtain the value of the i.m.e.p. by calculation.—*ATZ.*

Load Distribution over Tire-Ground Contact Area

Occasionally surprise has been expressed at the great amount of power which is being usefully applied to a single pair of driving wheels in modern racing cars. Take the 600-hp. Daimler-Benz racer, for instance, with which new road speed records were established recently. At the maximum speed attained in its record trials, the 600 hp. is said to have been fully utilized. This leads to the conclusion that the propelling force produced by the rear wheels was 968 lb. The car weighs 2200 lb. and if it is assumed that the transfer of weight from front to rear by the driving torque is about equal to the lift on the rear part of the car by the air pressure, the effective load on the rear wheels at top speed would be only 1100 lb., which would call for a friction coefficient of 0.88. However, direct measurements of the friction coefficient between tire tread and road surface have shown it to be somewhere between 0.5 and 0.7. This leads Dr.-Ing. P. Koessler and Dipl.-Ing. H. Klaue to the conclusion that other factors not recognized heretofore must intervene in the phenomenon, and they suggest the use of a new term, "power-transmission coefficient," to designate the ratio between the maximum tractive effort that can be produced by means of a tire and the net load upon it.

Experiments by Bradley and Allen have shown that it is impossible to apply forces of any magnitude to a wheel without causing slip. From their results it appears that a force producing an acceleration of 3 ft. per sec.^{2} will cause a slip of approximately 5 per cent. Wheel slip is due partly to distortion of the tire and partly to sliding on the road surface. The few experimental data available on this subject clearly show that the power-transmission coefficient is directly dependent on the kind and magnitude of the slip.

Effects of the inertia forces which come into play with the application of the brakes, on the tire, are illustrated in Fig. 1. In the upper view, for the sake of simplicity, the tire is shown in side view, developed, the length of ground contact being shown cross-hatched. The wheel rolls in the direction *V* and the contact surface moves in the same direction, relative to the tire. The inertia force *B*, which is transmitted by the tire rim, acts in the direction of motion.

If we imagine the tire to be cut radially into equal sections, these sections, in the developed view at first appear parallel and vertical. But at the contact surface the tire is compressed from its original height *h*. Before they reach the contact surface, the tire sections are stretched by the inertia force *B*. In this stretched condition, they pass over the contact surface, causing what may be called "tension slip," owing to the fact that the adhesion tends to hold the tire firmly to the momentary con-

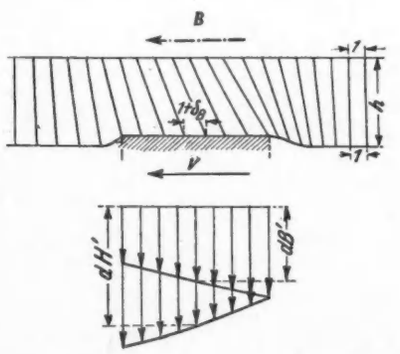

Fig. 1—Upper view: Developed side view of tire under braking conditions. In the lower view the upper series of arrows indicate the distribution of retarding forces dB' over the circumferential length of the contact surface, while the lower series of arrows indicate the distribution of vertical load and of adhesion over this surface.

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tact surface. Each section of the tire transmits braking force to the road surface in direct proportion to its extension (in accordance with Young's law). For the sake of simplicity it is assumed that the sections of the tire are of equal width (rectangular contact area). As a result of the longitudinal stretch, the inclination of individual sections increases from left to right, as indicated in Fig. 1, from which it may be inferred that the force transmitted by the sections increases from front to rear.

This variable inclination has still another effect. With increase in the inclination the vertical load dQ' on the tire sections decreases, and thus also the adhesion $dH' = \mu\ dQ'$ (where μ is the brake-force coefficient). When dB' becomes greater than dH', the adhesion no longer suffices for the transmission of the circumferential force. In Fig. 1 a case is shown where dB' becomes equal to dH' exactly at the end of the contact surface. If this point were further to the left, there would be sliding on the surface to the right of it, in which case the "tension slip" would merge into "sliding slip." Whether or not this condition of partial sliding is stable depends on the relation between the coefficients of static and dynamic friction. Probably, as a part of the tire tread loses its adhesion, the wheel is retarded by jerks. Thus it was found by Weil that with more than 30 per cent slip it was impossible to keep the brake from locking without very careful treatment and lubrication of the braking surfaces.

In the case of the driving wheel (Fig. 2) a compression slip is produced. In the drawing the driving force A is represented as equal to the inertia force B in Fig. 1. Individual sections of the tire are stretched only after passing out of contact with the road; ahead of and above the contact surface they are compressed, and the degree of compression is a measure of the power transmitted. Owing to the curved form of the stress-strain line for rubber, the compression due to driving forces is smaller than the extension due to braking. As a result, the inclination of the tire sections is smaller when driving. Distribution of the load over the contact surface, and therefore of the adherence dH', is more nearly uniform than when braking, so that a greater total force can be transmited (dA' as compared with dB' in Fig. 1.) This explains why under otherwise similar conditions the coefficient of driving adhesion may be greater than the coefficient of braking adhesion.—*ATZ.*

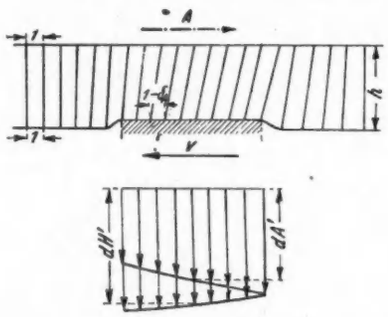

Fig. 2—The upper view is a developed side view of the tire under driving conditions.

Fuel Pumps for Airplanes

In a paper on Fuel Pumps for Aeroplanes, read before the Derby Center of the Institution of Automobile Engineers by W. C. Clothier, technical officer of the Royal Aircraft Establishment, such pumps are divided into three classes, viz., centrifugal, displacement with valves, and displacement of the interference type (which latter are usually without valves). In respect to the general requirements it is pointed out that the fuel, being a consumable load, should be placed as near the center of gravity of the plane as possible, in order that the trim may not be disturbed. This applies particularly to such craft as heavy bombers, where the fuel may represent as much as one-fourth of the total load at the start. The pressure of fuel feed on an airplane may be affected by accelerations and decelerations of the plane, which are a maximum when pulling out of a steep dive or when making a steeply-banked turn. This acceleration may reach 3 g in civil and heavy military planes, which means that a 3-ft. vertical lift becomes equivalent to 9 ft. while the acceleration lasts. With high-speed military planes an acceleration of 5 g has been observed. The fuel pump must deliver fuel to the carburetor against a pressure varying between 0.3 and 4 lb. per sq. in.

Modern fuel pumps are divided into four classes, viz., diaphragm pumps, piston pumps, vane pumps, and gear pumps. Quite a number of different pumps are described and illustrated (by sectional drawings) in the paper, including three of American origin (D.H.A.C., Evans and Romec). Fuel pumps of foreign origin described include the Amal, Armstrong-Siddeley, Pobjoy-Tecalemit, "Korrect," Hobson, A.M., Bristol, Napier and Rolls-Royce.

Almost all successful pumps of the diaphragm type employ fabric diaphragms. If the pumps are to develop large suction lifts, it is essential that the valves do not leak. Dry suction lifts up to 18 ft. are obtainable with this type. Several engine-driven piston-type pumps have been developed for use on engines with fuel injection and could be readily adapted for use with carburetor engines. These pumps, to be dependable, require the pis-

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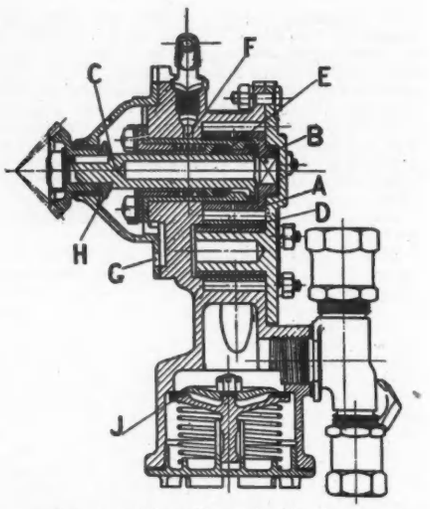
ton to be a very close fit, and as gasoline is a poor lubricant, special attention has to be paid to the materials used. The type is suitable for use at a distance from the engine, by means of a fluid under pressure, or by suction, some of the pistons being used to drive the rest; but so far it has not come into extensive use. The gear pump is probably the simplest of all, but it has been discarded in America on account of the difficulty of compensating for wear and maintaining the suction lift. Two prominent British manufacturers of aircraft engines, Napier and Rolls-Royce, use this type of pump. A sectional view of the Napier pump is shown herewith. The pump gears are of unequal size. The larger one, *A*, is of phosphor bronze, with a babbitt-metal lining which runs on a phosphor-bronze bush fixed in the pump casing. It is driven through the square *B* on the end of driving shaft *C* and engages the smaller gear *D*. The latter is of stainless steel and runs on a babbitted phosphor-bronze bush on a pilot formed on the pump cover. The gears are suitably drilled and grooved to allow free access of fuel for lubrication. End float is kept between 0.002 and 0.0035 in. and diametral clearance between 0.0025 and 0.0040 in.

Leakage past the driving shaft is prevented by a spring-loaded virgin cork gland *E*. Lubricating oil under pressure is led to the engine side of the gland at *F*, and a drain is provided in the casing at *G*. Return of oil to the engine system at the rear of the bearing is prevented by an oil thrower *H*. The relief valve *J* is of the mushroom pattern, with a leather washer to form the seat, and the spring controlling this valve is of phosphor bronze. All fuel passing the relief valve is returned to the tank through a return pipe, and thus does not go directly to the suction side of the pump. This prevents changes in the delivery pressure with changes in altitude, so long as the return pipe does not run full, and it also assures that the pump suction is not spoiled by leaking relief valve.—*Journal of the Institution of Automobile Engineers.*



Cross section through Napier gear-type fuel pump

Mounting Injection Nozzles on Diesel Engines

The mounting of injection nozzles on Diesel engines is discussed in a recent issue of *Automobiltechnische Zeitschrift*, by Karl Schwaiger of the Daimler-Benz Company.

Bosch injection nozzles have a cylindrical inner end 0.547 in. in diameter, and it is recommended that for the nozzle mounting the cylinder head be bored out to a diameter of 0.571 plus or minus 0.008 in. This leaves an annular gap of from 0.008 to 0.016 in. width, if the injector is located centrally in the hole, but if it should be hard over to one side, then the width of the gap on the opposite side may be as much as 0.032 in. The burning gases, whose temperature is in the vicinity of 3600 deg. Fahr., get into this gap and raise the inner end of the injector to a very high temperature. By means of a thermo-couple the lower end of the injector has been found to reach a temperature as high as 650 deg. Fahr. This is very close to the end point of the distillation curve of Diesel fuel, with the result that the lighter fractions of the fuel are likely to be driven off and the non-volatile tarry matter in the fuel will be deposited on the inner walls. This causes trouble from sticking of the nozzle valve.

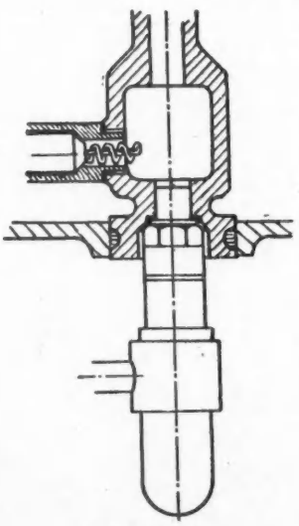


Figure 1

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The annular clearance around the lower end of the injector was found to be essential to the proper operation of the nozzle, and as it was thus impossible to prevent heat from entering the nozzle, attempts were made to keep down the nozzle temperature by providing it with increased facilities for getting rid of heat. One scheme consisted in providing a heavy washer of a material of high heat conductivity between the nozzle and its seat on the cylinder head, this washer extending a considerable distance beyond the diameter of the nozzle and having a double edge, to increase its radiating surface. In other designs the central cylindrical portion of the nozzle body was made a close fit in the bore in the cylinder head, and in some cases even an annular space was provided around this portion of the nozzle body which communicated with the water jacket of the head. These measures, however, were found to be of very limited effectiveness, as

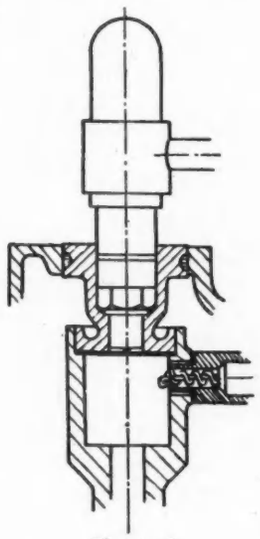


Figure 2

the paths of heat flow were quite long and the cross sections inadequate.

Figs. 1 and 2 show a mounting developed at the Daimler-Benz works some years ago. A washer or gasket of soft copper is inserted between the end of the nozzle and its seat in the nozzle holder, which not only completely shuts off the clearance space from the combustion chamber but also protects the end surface of the nozzle from contact of the flame. In order to assure a positive closure, the central part is made to project 0.004 in. below the shell. When the injector is fastened down, the copper washer is plastically deformed by the central part until the shell or outer portion is firmly seated on it, as shown in Fig. 1.

Measurements with a thermo-couple located between the nozzle and the copper washer showed a maximum temperature (at 2000 r.p.m. and 88 lb. b.m.e.p. of the engine) of 375 deg. Fahr., while below the copper washer the temperature was as high as 1100 deg. Fahr.

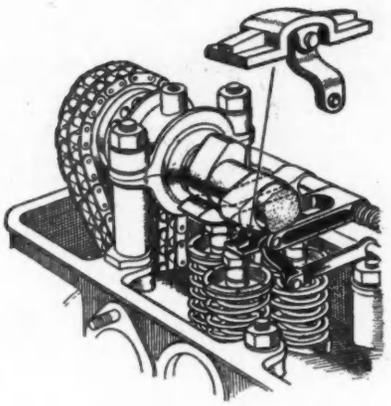
Protection of the nozzles against excessive temperatures is particularly important in the case of two-stroke and very high-speed engines.—*ATZ.*

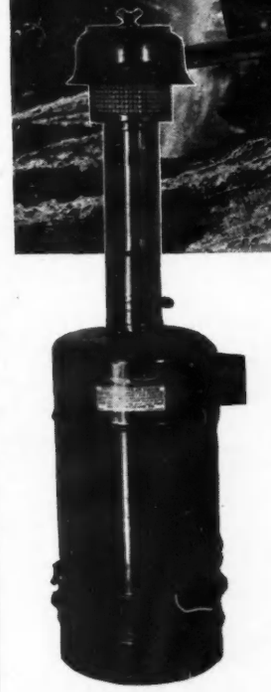
High Performance Sport Car

A high-performance "sports" car of really modern design has been placed on the British market under the name of Atalanta. It has independent suspension all around, a supercharged engine (the supercharger can be cut in at will), and the cotal magnetically-controlled planetary transmission. The independent suspension consists of double coil springs, one within the other and separated by a leather sleeve. The front pair are mounted vertically and high up, being supported by a tubular member passing behind the radiator shell. Two parallel longitudinal arms pivoting together to assure consistent caster action, hold the steering head, one acting against the spring, the other against the shock-absorber. The rear springs are mounted horizontally and low, coming within the frame, which is underslung at the rear, the rear wheels being mounted on cranks.

A four-cylinder engine is fitted, with overhead camshaft, with drive by two two-strand roller chains in series, which also drive the various accessories. There are two inlet valves per cylinder (in the head) and one exhaust valve. The supercharger is the Centric, a positive-displacement type that was described in these columns about

Valve arrangement, overhead camshaft, and camshaft drive of Atalanta engine.





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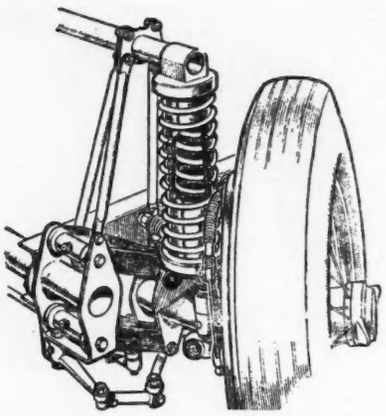

Front independent suspension by dual coil springs of Atalanta car.

a year ago. It is set in operation when wanted by means of a hand-controlled friction clutch.

The car is being offered in two lengths of wheelbase, 108 and 117 in., and with optional engines of 91 and 122 cu. in., both four-cylinder. The complete chassis weighs 1624 lb. and the complete (open sports) car, 1900 to 2000 lb. Prices range from about $2,500 for the unsupercharged open sports car with the small engine, to about $3,000 for the supercharged coupe with the large engine.—*The Autocar.*

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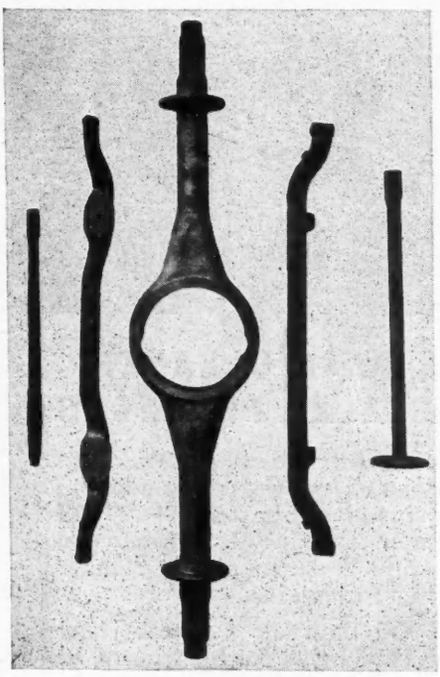

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A Means to Obviate Effects of Impurities in Batteries

It is well known that certain impurities, even when present in very small proportions, are very detrimental to the operation of storage batteries. On the other hand, efforts have been made to find materials which would obviate or at least reduce certain undesirable effects which result in shortening the life of batteries.

The active material of the positive plate loses its coherence as a result of repeated charges and discharges, which consist in the conversion of lead sulfate into lead oxide and vice versa. When this takes place there is an accumulation of "mud" at the bottom of the cell.

It has been suggested that an addition of approximately one gram of chromium salt per liter of sulfuric acid will reduce the accumulation of lead mud. The addition of boric acid has also been proposed.

Negative plates have a longer life than the positive ones. Therefore, any process which adds to the life of the positive plates increases the life of the battery. On the negative plate the finely divided lead agglomerates in the course of time, its surface diminishes, the mass hardens, cracks and becomes detached from the grid. This naturally results in a loss of capacity and the impossibility of high rates of discharge.

To overcome this difficulty it was proposed by Kieseritzky and Roloff as far back as 1904 to add organic materials, and preferably colloidal substances. Wood and wood extracts proved the most efficient. Laminations of wood between perforated plates of hard rubber are used as separators for traction-type storage batteries. With plain hard-rubber separators the batteries were found to have a shorter life.

A growth in the grain of the lead and also of the lead oxide is observed if the plates are stored dry before being assembled. Goetze has suggested that such plates be immersed in a bath of zinc sulfate. In that case solid material will be deposited between the fine particles of lead and keep them from agglomerating.

Corrosion of the terminals is prevented by the addition of 0.1 per cent of sulfate of cobalt.

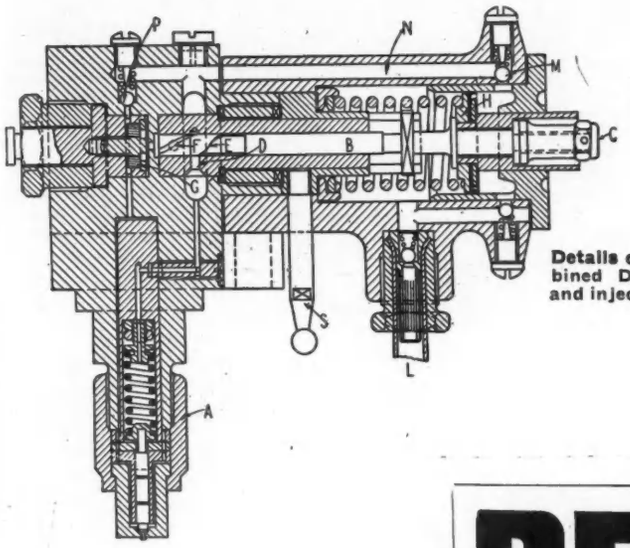
When a storage battery remains idle for a long time, the small crystals of lead sulfate become dissolved and increase the size of the larger crystals. The latter are much less soluble and much less inclined to become retransformed into lead and oxide of lead. The plates become hard, of a less dark color, and buckle. Several metals as well as organic materials have a favorable influence. Mention may be made of the addition of phosphoric acid up to 20 grams per liter of sulfuric acid.

When idle, a storage battery discharges slowly, as a result of chemical reactions between the lead, the acid, and bivalent and quadrivalent lead oxides. Precious metals particularly accelerate such reactions, but also the hard lead antimony of which the grid is made. No additions are known which will inhibit this effect, and a better plan seems to be to look for other materials for the grids, such as lead-cadmium or lead-calcium, for example.

According to Tommasini, light has an influence on the formation of the positive plates. From this it would seem that the addition of coloring materials might be of advantage.

As the capacity of the positive plates is materially smaller than that of the negative ones, there is point only in seeking to increase the capacity of the positives, as, for instance, by adding acids other than sulfuric, but unfortunately the grids are very rapidly attacked.

By increasing the discharge voltage the energy output is increased; this is accomplished by an increase in the density of the sulfuric acid solution itself or by the addition of sulfates of lithium, sodium, manganese, etc. An addition of copper sulfate reduces the charging voltage of the negative plates. A reduction of the tension of the charge also increases the efficiency of the battery. For instance, an addition of 0.1 per cent reduces the charging pres-



Details of the combined Diesel pump and injection nozzle.

sure 0.03 volt without any detrimental effects with respect to other characteristics of the battery.

Loss of electrolyte must be guarded against especially in the case of portable batteries. A scheme tried many years ago consisted in adding one volume of sodium silicate (water glass) of 1.20 specific gravity to four volumes of acid of 1.24 specific gravity, stirring energetically while filling the cell, as this mixture coagulates in 15 minutes. As soda salts have a deleterious effect on the terminals, Wolf has suggested the use of a solution of colloidal silicic acid. The addition of such a mixture results in a drop in discharge voltage and of capacity.

During the charging operation gas is evolved and the gas bubbles entrain acid which is both irritating and corrosive. A coating of a mixture composed of one part gasoline and two parts of paraffine oil, suggested by Rittinghaus, not only prevents evaporation of the water of the electrolyte but at the same time protects the electrolyte against the influence of the air and, as has been pointed out by Ch. Fery, diminishes the loss of charge when not in use. A more fluid liquid is without effect, a too viscous liquid gives rise to the formation of foam.— *Chemische Fabrik,* abstracted in *La Technique Moderne.*

Combined Transfer Pump, Injection Pump and Nozzle

A British patent on a combined pump and injection nozzle has been granted to British Thomson-Houston Co., Ltd. (magneto manufacturers), and L. Griffiths. By combining these elements into a unit, the difficulties due to surges in the high-pressure line are eliminated. Referring to the drawing, the injection nozzle is shown at **A** and has a spring-loaded needle valve. **B** is the plunger of the high-pressure fuel pump, which is actuated by a cam or eccentric contacting it at **C**. The fuel supply is cut off by the plunger overrunning port **D**, and relief occurs when the helical relieving edge **E** overruns the grove **F**. The fuel then passes through filter **G** to the nozzle. The flanged bushing **H**, which is secured to the plunger, is used for the transfer pump. Its reciprocating motion draws fuel from the supply line **L**, through a non-return valve **M** and along passage **N** to the barrel of the high-pressure pump. An unloading valve **P** is included. The quantity of fuel supplied by the injection pump is varied by the rotation of plunger **B**, by means of lever **S**. The main feature of the invention is the elimination of the necessity of drilling small holes.—*The Automobile Engineer.*

Frazer-Nash Independent Front-Wheel Springing

The Frazer-Nash-B.M.W. chassis, of German origin, is at present being assembled at the works of A.F.N., Ltd., Isleworth, England, but it is the intention to later manufacture it there. The car is of rather unorthodox design, among its unique features being the tubular chassis frame and the independent front suspension, of which latter drawings are reproduced herewith.

There is, of course, no front axle in the orthodox sense. The frame terminates in a short cross-member, and on the upper part of this is mounted the single transverse spring which provides the front suspension. Each end of this spring is attached by a bolt passing through its eye to ears on the upper part of the pivot pin,

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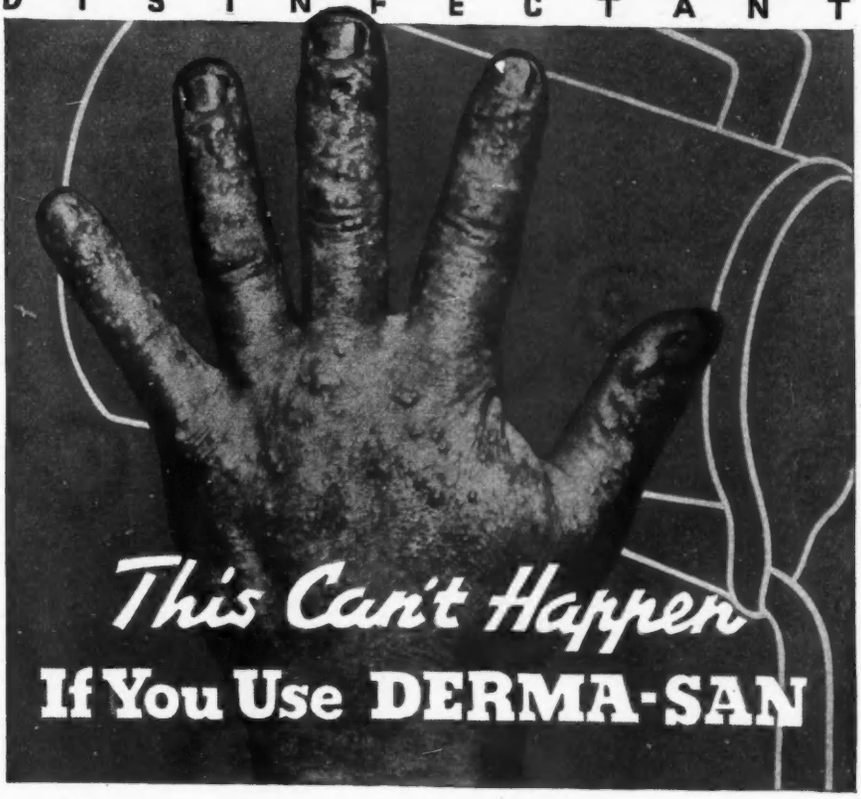

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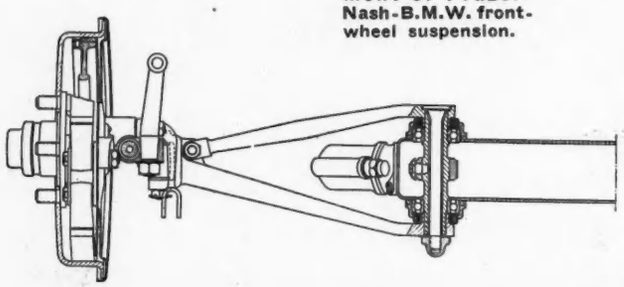
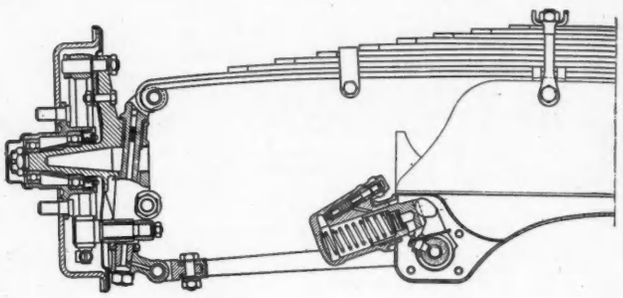


General arrangement of Frazer-Nash-B.M.W. front-wheel suspension.



while at the lower end of the pin is a boss, to which is attached the forked end of one half of a wishbone lever, the other half being attached by a bolt to the main lever. At the wide end, the lever is closed by a sleeve and pin passing through bosses arranged on the front cross-member, and in which two ball journal bearings are fitted. At the center of this sleeve is a short vertical lever terminating in a cam which bears on the piston of a hydraulic shock absorber. It should be noticed, however, that the oil only acts in one direction, the piston being returned by a coil spring. A needle-valve adjustment controls the rate of oil flow. In the event of spring breakage the wishbone levers and shock absorbers are sufficiently robust to support the wheel.

The stub axle is a particularly strong construction, and is formed in one with the brake bracket. The hub runs on two journal ball bearings having a tapered distance piece between them. Generous radii are provided at each change of diameter in this member.—*The Automobile Engineer.*

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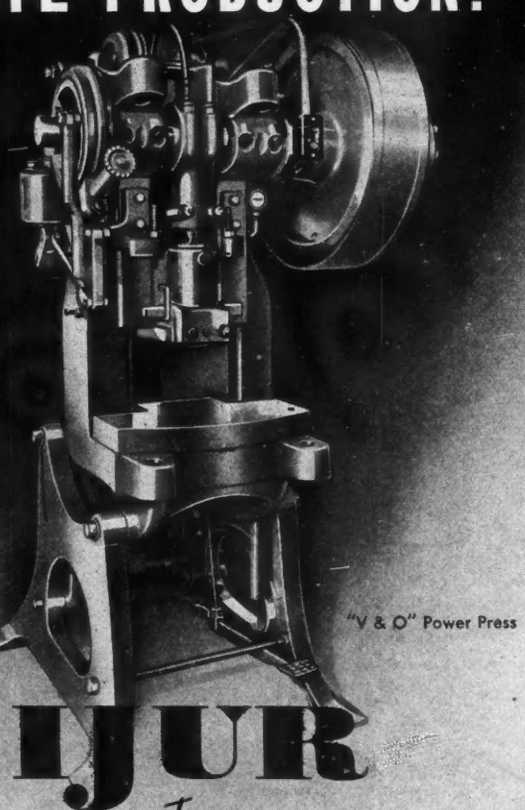

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Studebaker Equips for 1938

(*Continued from page 319*)

heating coils, air washers and filters so that the fresh air going into the spray room is filtered and humidified, to maintain exactly the same atmosphere in the spray room at all times regardless of outside weather conditions. The fresh air is distributed into the room through a perforated sheet metal duct arranged to allow even distribution throughout the entire length of the spray room. Spray booths are set up for spraying two coats with one baking operation. The booths are spaced approximately 10 ft. apart so as to have a slight time for air set-up before the second coat is applied; then the bodies are carried into an oven where they are baked for approximately one hour at a temperature ranging from 225 to 275 deg. F., depending on the painting specifications.

Ford Radio Hour Resumes

The Ford Motor Company will begin its fourth season of Sunday evening concerts on September 12. Jose Iturbi will direct the 75-piece Ford Symphony Orchestra and the chorus for the first eight weeks. Others to take over the baton during the season will be Eugene Ormandy, Alexander Smallens, and Fritz Reiner. Soloists taking part in the season's program include Richard Crooks, Kirsten Flagstad, Lucrezia Bori, Lauritz Melchior, Lotte Lehman, Jascha Heifetz, Yehudi Menuhin, Lily Pons. W. J. Cameron, of the Ford Motor Company, will again be heard during each intermission. The programs will be broadcast over 97 stations of the Columbia Network every Sunday beginning September 12 from 9 to 10 P. M., CNYT.